Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 25. CHICAGO, SATURDAY, DECEMBER 20, 1919. PAGE 1003.

Fig. 1.—Truck Type Panels for the Main Control Board.

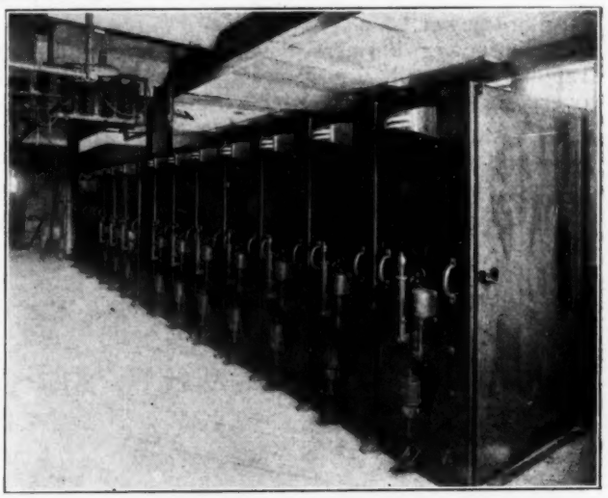

Fig. 2.—Truck Type Panels for 2300-Volt Single-Phase Feeders.

Selecting a Switchboard for a Plant of Moderate Size

How a 30,000-kw. Central Station Came to Select a Truck Type Switchboard — Comparison of Cell and Truck Types—Paper Before Pennsylvania Electric Association

By G. E. WENDLE

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ABOUT the year 1904, the developments about Williamsport indicated clearly the need of a new and efficient generating and distributing plant. This plant was duly authorized, and particular attention was given to the switchboard in the matters of accessibility, convenience and safety and of provision for large future growth.

The board was of the standard marble panel type, supported by a pipe framework upon which the various apparatus was mounted. In order to provide ample space for operation and for safety, the face of the board was placed 8 ft. from the building wall, and when completed and all of the existing outgoing feeders connected, the general effect was one of spaciousness and our satisfaction was complete except for one thought—where was the business to load the spare panels we had bought?

At the time this board was placed in service the principal load on the combined systems was street railway and lighting. Commercial power was only a small percentage of the total output, and what little there was of power was mainly incidental to the large lighting installations. There was not a single polyphase motor on the system except those at the generating station.

The reason for this condition is evident when you consider that the majority of our manufacturing plants were engaged in various woodworking lines and obtained large quantities of wood waste in manufacturing. In order to get rid of this waste, specially designed boiler plants were installed to furnish steam for power and dry-kiln service, and it was a fundamental belief among the majority of our manufacturers that their power not only cost them nothing, but even saved them the expense of hauling the waste away. Under such circumstances our expectations in the addition of power loads were very, very modest. Hence, in planning our board, we provided power panels largely as a matter of faith, and because everybody we talked to, including the salesman, assured us that no self-respecting central-station board was complete without a full line of these panels.

As the years rolled around, we managed to pick up a few power services—mainly to operate special machines in plants where the engines were overloaded or for emergency conditions. The convenience of the

motor drive, the added production, and the lessened risk of complete shutdown gradually resulted in additional permanent motor installations in spite of the cheap waste fuel. Finally the development of special machines by which much of the so-called waste could be worked into fillers for veneered doors, etc., and the increased local market for the smaller pieces for kindling reduced the "waste" materially. Power was no longer obtained for nothing—the coal account in the ledgers ended that dream, and we began to add on more power.

The power business developed more and more rapidly until we had used up all of the power panels, overflowed into the reserve lighting panels, and had

Fig. 3.—Truck Type Panels for 6600-Volt Three-Phase Feeders.

even tied in extra power feeders on existing lighting feeder panels. The old spaciousness disappeared; congestion was everywhere. It was almost impossible to obtain proper clearance spaces so that our operating men could attend to the operation, inspection and maintenance of the various apparatus properly and safely. We devised various ways and means to expand the old board; but the additional capacity obtainable was not worth the price and there still remained the inadequacy of the remodeled board in the matters of safety to our service and to our operators. There was but one proper remedy—a new switchboard, with ample room for expansion. The question was: What type of switchboard was best adapted to our requirements, or to the needs of any station of moderate capacity and voltage?

As a necessary preliminary, the ultimate station capacity, the maximum size and voltage of generating unit, and the probable number of feeders were carefully estimated upon the operating data of the present equipment and the anticipated development of our tributary territory. The figures assumed for these several items were as follows: 30,000 kw.; 7500 to 10,000 kv-a. at 11,000 volts, and 16 three-phase and 10 single-phase feeders in addition to our present lines. These estimated additions actually provided for three times our present capacity and between four and five times our present output.

It was further proposed to build a switchhouse addition to our present plant, in which all switching, controlling, regulating and protective apparatus would be placed. This decision eliminated any switchboard system which did not permit close grouping of the various units; and really limited our choice to three systems, namely, the usual panel type, consisting of a pipe framework which supported the various apparatus, etc., and on which were mounted the marble or slate panels with operating handles, instruments, etc.; the cell type with benchboard control; and the safety enclosed removable-truck type with remote control of all main or master trucks.

After a short study of the panel type, it was eliminated because of the large number of exposed high-voltage parts and the difficulty in meeting the present and anticipating the future requirements of our state safety code in the matter of isolation of dangerous parts. This isolation involved screens, etc., and when these were added, the cost was largely increased and the accessibility greatly reduced. In addition, the present tendency towards more stringent safety requirements made us doubtful of the permanence of our investment in this type of board.

The matter of selection was thus reduced to the cell and the safety enclosed truck types, and as these two types were available in units of ample size and were practically equal in cost for equal number and subdivision of units, the final choice was made after careful consideration of the relative merits of these types under our local conditions.

Essential Requirements of the Installation.

In order to determine some standard basis for comparison of switchboard types, we made up the following list of features which we considered essential in our case:

1. Reliability and continuity of service.
2. Safety to employes and the public.
3. Facility of installation.
4. Facility of inspection and maintenance.
5. Economy in operation.
6. Localization and isolation of troubles and consequent damages.
7. Time required for resumption of service after any interruption due to the switchboard.
8. First cost.
9. Reserve equipment required.
10. Provision for future growth.

Let us consider these features seriatim, assuming that both the cell and truck types have the same subdivisions of the same capacity.

1. *Reliability and Continuity of Service.*—Absolute reliability and continuity are impossible, but an examination of large modern switchboards shows how far designers have gone along these lines. In many of the larger plants duplication is carried to extreme limits, but in every case with which we are familiar duplication was limited to some particular step in the progress from the generator to the outgoing feeder. Usually the main generator leads were not in duplicate, but at the generator panel these leads could, by duplicate oil switches, be thrown on either of the duplicate main buses. Throughout the rest of the board the duplication was carried out as far as the outgoing feeder lines. This method represents the most advanced practice where large amounts of energy are distributed in large units, and commercial considerations warrant the increased investment.

The questions which the station of moderate size must solve are—what investment is warranted by the revenues from the energy distributed and how much will the customers pay for extra insurance of the service against breakdowns and interruptions. These questions can be answered only from a thorough knowledge of local conditions. In our case, we were

sure that duplication must be of limited extent and that any extensive safeguarding of the service must be obtained through higher factors of safety in the matters of carrying capacity of the apparatus, insulation of the high-voltage parts and subdivision of the board by fireproof partitions. Having reached this conclusion, we investigated the cell and truck types on the same basis of subdivision, equipment, etc., and found that the devices and separate compartments used were the same in both types; but the material used in making up the compartments, the supporting system for the operating devices and the relative locations of these devices were different. Essentially these types are similar, and for the kilowatt capacity involved in our plant we concluded that equally reliable and continuous service would be obtained from either type.

2. *Safety to Employes and the Public.*—As all high-voltage parts are placed in closed compartments in both types, there is equal safety as far as regular operation is concerned, but when maintenance or repair work is required on oil switches and other apparatus, the removable-truck type, as an inherent feature of its design, must be made absolutely safe in order to get at any of the high-voltage parts. With the cell type the same degree of safety requires opening various separate disconnecting switches, carefully checking the same and making proper voltage tests. In short, the removable-truck type is *positively* safe, while the cell type is *possibly* safe.

3. *Facility of Installation.*—The cell type demands high-grade masonry or concrete construction, involving difficult forms and accurate template work. This requires first-class and experienced mechanics—under present labor conditions very difficult to secure in the smaller communities. After the foundation work is done, skilled electricians must be used in assembling and connecting the various operating devices which make up the board.

The removable-truck type is delivered "knocked down" as far as the compartments are concerned, but the removable trucks assembled. The exact work required is placing and leveling certain drilled channels of light section in the concrete floor and which serve as the foundation upon which the structural steel cells are erected, and two additional light channels per cell which form the tracks on which the truck panels are rolled. The high-grade fitting work and any necessary adjustment of parts to insure interchangeability of the trucks of the same type are attended to at the factory where specially trained men and the necessary jigs, templates and special tools are available for the work. The installation is thus reduced largely to assembly of fitted parts and does not require a staff of skilled mechanics to insure satisfactory results.

4. *Facility of Inspection and Maintenance.*—There is practically no choice between the cell and removable-truck types in the matter of inspection, but when inspection indicates that repairs, renewals or adjustments are needed, the removable-truck type has considerable advantage. The particular truck which requires attention is pulled out, a spare truck is substituted in the cell and service is immediately available. The truck which has been removed can be

Fig. 4.—Arrangement of Disconnecting Switches and Lightning Protective Apparatus.

wheeled to a suitably equipped workshop where all operating, controlling and measuring apparatus can be inspected in detail and completely tested out. Any necessary maintenance work can be done quickly, conveniently, thoroughly and safely, and when completed the truck can either be set aside as a spare or replaced in its usual compartment.

With the cell type, the entire unit must be cut off and *kept off* until the necessary work is completed and tested. In addition, this work must be done on the various appliances, etc., at their permanent locations, with all the inconvenience due to inaccessibility of parts and the inadequate working space. In general, this means more time to do the work thoroughly and often results in doing *only what is absolutely necessary,* instead of completing *all of the work.*

5. *Economy in Operation.*—As long as regular service conditions prevail, the operating force has little to do except the periodic inspection of the indicating and controlling apparatus, but in order to provide for possible troubles or emergencies which occur with switchboard apparatus and wiring, it is essential that the operating men shall be of proper caliber to insure resumption of service in the minimum time and with the maximum safety to the plant and the consumers.

With the cell type, we would require on each shift at least one skilled operator who had exact and detailed knowledge of the switchboard and wiring and who could quickly and confidently carry out the requisite manipulations and emergency work without referring to diagrams, etc. When the service in any district is knocked out there is no time to be lost in locating and examining blueprints or diagrams or in consultation. This work demands specialized skill and training, good judgment and considerable resourcefulness and commands pay commensurate with these requirements and responsibilities.

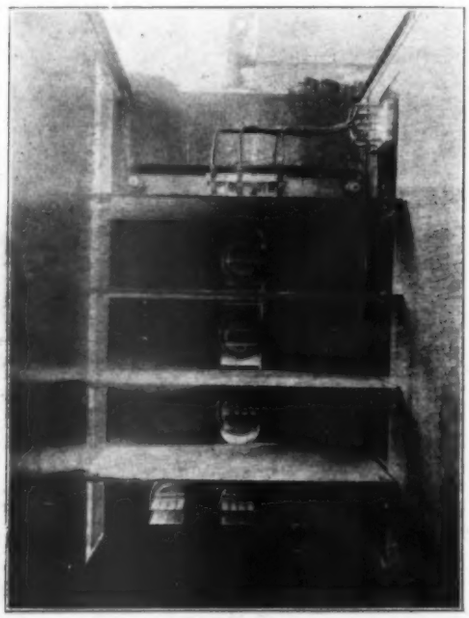

Fig. 5.—Truck Housing Showing Disconnecting Devices and Barriers.

With the truck type, we would require men of average intelligence who can be taught and be depended to observe irregular or defective operation and who can be drilled so that in case of trouble they can quickly remove the truck involved, replace it with a spare truck and resume service. The faulty truck can be wheeled out of the way and a report of the trouble made out for the chief engineer. There is no need of specialized knowledge of the apparatus and wiring nor of making any detailed investigations or tests to locate the faulty part

6. *Localization and Isolation of Trouble and Consequent Damages.*—As both cell and truck types consist of a series of separate compartments, the only question is the relative safety of masonry or concrete cells and steel. On this point we had some doubts, particularly where complete reinforced concrete cells were installed, but as our examination showed that the large-capacity generator and master truck panels were installed in cells constructed with reinforced concrete sidewalls, our fears were dissipated as far as the main truck panels were concerned. The remaining all-steel cell construction housed the feeder trucks of smaller capacity and any damage due to truck breakdown was not likely to be either serious or extensive, particularly as the energy supply to this entire feeder group was limited and protected by a master truck panel.

7. *Time Required for Resumption of Service After Any Interruptions Due to the Switchboard.*—With either type the trouble must be investigated and located. If the switching apparatus or wiring is at fault, the cell type requires that the faulty unit be cut out and repaired before service can be resumed, but with the truck type the faulty truck is pulled out and replaced by a spare truck and service resumed.

In order to obtain fair data on the time required to change trucks, tests were made with men of ordinary physique and average intelligence, but without special drilling or experience in handling the trucks. The series of operations were as follows:

A. Go to a designated faulty truck and remove that truck from its cell.

B. Go to the spare truck, remove it from its usual cell, move it into proper position to enter the faulty truck's cell, and push the truck home.

C. Close the oil switch, thereby locking the truck in place and resuming service.

The time required for the smaller feeder truck was 30 seconds, and for the main trucks 1 minute, 45 seconds.

These tests indicated clearly the great advantage of the truck type when emergency conditions must be handled quickly and surely by men of average capacity.

8. *First Cost.*—For the same number and subdivision of generating and distributing units, the cell and truck types were estimated as approximately equal in cost. The truck type cost was more certain, as its cost was determined very largely by the contract terms. The cell type cost was definite as far as the apparatus and appliances, but there was a large estimated portion which was subject to considerable doubt because of the fluctuating labor and material costs and existing uncertainties. We concluded that a cell type installation would certainly cost as much and probably would cost more than a truck type.

As a further comparison, a complete equipment of trucks and cells cost approximately one and one-third times the older standard panel type, with pipe framework in the rear and manually operated apparatus mounted thereon.

9. *Reserve Equipment Required for Proper Service.*—In order to insure reasonable continuity of service, the cell type requires sufficient reserve stock of assembled apparatus, etc., to provide for quick replacement of any damaged or defective apparatus, etc., by a complete spare. This means at least one assembled

spare for each size and type of apparatus used in the switchboard. In addition, there is required a complete supply of repair and renewal parts for the various sizes and types of apparatus.

The truck type requires as many completely equipped spare trucks as there are separate groups used in the switchboard. These spare trucks are housed in special cells, located conveniently for immediate use. The additional stock is limited to a complete supply of repair and renewal parts for each size and type of apparatus.

The truck type is on a par with the cell type as far as repairs and renewal parts are concerned, but the spare truck with complete equipment ready for immediate use is enormously more valuable from the service standpoint than any stock of spare apparatus, which must be located, mounted and connected before it is of any service value.

10. *Provision for Future Growth.*—It is assumed that the same amount of floor space will be provided regardless of the type of switchboard, and that the cell and truck units will be equal in number and capacity in the original installations and in future extensions until the floor space is taken up. Under these conditions and up to the limit of available space, there is a slight difference in favor of the truck type by reason of the lesser wall thickness of its steel compartments.

With the cell type, whether of brick or concrete, the group of cells must be torn down and a new group constructed for mounting larger capacity switches, etc. This would take considerable time, as it involves tearing down and removing the old masonry, setting up new forms, building the new masonry and waiting a sufficient time for the mortar or concrete to set properly before mounting and connecting the various apparatus. During this period of reconstruction, considerable temporary work must be done to continue service safely on the feeders or units involved, and such work is usually expensive if properly safeguarded.

With the truck type, the problem is largely one of increasing the capacity of the fixed main contacts and connections to the buses, and of replacing the smaller apparatus on the trucks with larger capacity apparatus of the same type. Service would not be interrupted, except for the short time necessary to place larger main contacts and heavier connections to the buses. No extensive reconstruction of the compartments would be required, as the dimensions are ample for the largest future units contemplated. We therefore considered the truck type particularly advantageous in handling increased capacity requirements economically.

Finally, if the capacity of future units exceeds the maximum rating of available truck panels, we can construct the necessary cell type units to take care of such larger apparatus and leave the existing truck panels which are adequate in capacity for their particular service undisturbed. From this standpoint, the truck type seemed to offer greater permanence in service and less depreciation than the cell type.

Description of the Installation.

In the foregoing analysis, we have tried to present the considerations which resulted in the selection of the truck switchboard for our entire alternating system. The complete board is installed and a description of its main features, together with the general layout of wiring, etc., from the separate panels to the overhead system, may be of interest. Your attention is particularly called to the care in designing the layout of the switchboard, wiring, regulating and protective apparatus so that all parts are readily accessible for operation and maintenance. This latter point is, in my opinion, fundamental to the reliability and continuity of service and is generally given small attention until too late to change.

The equipment of the station which the truck panels are to control consists at present of two 6600-volt, 7500-kw., three-phase generators and one 2300-volt, 2500-kw., quarter-phase generator with an ultimate capacity of 30,000 kw. These sources of power

Fig. 6.—Truck Housing, Showing Bus Compartment and Method of Bringing Up Cables.

are interconnected by means of 6600-volt, three-phase and 2300-volt quarter-phase transformers.

The generators, transformers and group feeder circuits are controlled by means of safety-inclosed truck panels equipped with General Electric type FK-12 solenoid-operated oil circuit-breakers. See Fig. 1.

The 2300-volt single-phase lighting feeders and the 6600-volt three-phase feeders are controlled by means of safety-inclosed type truck panels with manually operated type FK-5 oil circuit-breakers. See Figs. 2 and 3.

The control switches for the solenoid-operated oil circuit-breakers on the trucks, together with the instruments, meters and relay equipment, are mounted on an independent slate switchboard of the standard vertical type.

Secondary instrument and control leads only are brought to this board and when the board is inclosed at the ends with grille work the installation will be provided with all the necessary features of safety.

The main control board and the truck panels are mounted on the main floor. The feeder leads from the truck panels run up to the second floor, where the feeder regulators are located, and then up to the third floor to the lightning arresters, choke coils and disconnecting switches, as shown in Fig. 4.

From the third floor the feeder circuits are carried upward through the roof of the station and then to the overhead distributing system. Figs. 5 and 6 show some of the constructional details of the safety-inclosed truck type panels as installed.

Central-Station Rates in Theory and Practice

Twenty-fourth Article—Commission Procedure in Rate Cases—Valuation for Rate-Making Purposes—Changing Attitude as to Importance of Valuation—The Different Bases of Valuation

By H. E. EISENMENGER

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This series of articles, of which this is the twenty-fourth, began in the issue of July 12. The first seven articles, forming Part I, dealt with the cost of electric service. Part II contained six articles on the principles governing selection of a rate system. In the six articles of Part III were described the various systems of rates found in practice. Part IV included two articles on rate analysis, while Part V discussed accuracy of rates. The present article is the third one of Part VI on commission regulation of public utilities. Next week's article will close the series.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION—Continued.

CONTRIBUTED BY S. F. WALKER,
Formerly Associate Editor of Rate Research.

III. PROCEDURE IN RATE CASES.

THE commissions on first taking up their responsibilities, without precedent to guide them, with little chance of pleasing both parties to a controversy and the probability of pleasing neither, sought to base their decisions upon carefully prepared data so that the justice of their orders might be proved in mathematical terms.

In rate cases the responsibility of the commission lay in securing for the public rates as low as were consistent with good service and at the same time in securing to the company a reasonable income covering all operating expenses, including allowance for the inevitable depreciation of the property and, over and above this, a reasonable rate of return.

VALUATION OF UTILITY PROPERTIES.

To determine upon just what amount the company should be permitted to base the return, the commission made extensive and detailed valuations of the properties. These were often drawn out over many months. In some of the earlier rate cases it would be two or three years after the filing of the complaint before the final rate order was entered.

When a rate case opened up, the commission's valuation engineers went out to make a valuation of the company's property, and, because a rate investigation was a new and untried experience, the company's engineers were also set to work making a separate and complete valuation and, in most cases in a city of any size, a third valuation was prepared by engineers for the city. The different interests of these three sets of engineers led to widely different results and at the hearing before the commission the different arguments were presented, substantiating the findings of the different appraisers. When it came to the writing of the commission's opinion this extensive debate was reflected in a lengthy opinion passing upon the merits and demerits of the different valuations and the arguments presented on the different values making up the total. As a matter of fact, a careful reading of the opinion would not always disclose just what had been used as the final rate base. But the practice of making these extensive valuations was continued, showing the desire of the commissions to determine mathematically the justice of the decision on rates. Arguments and counter arguments were heard, and different bases of valuations were proposed. It would appear that a valuation worth making at all would be worth making well, but the difficulty is that the whole matter is fluid—the property values do not stand still, unit prices fluctuate, depreciation goes on, improvements and extensions are necessary, new developments cause property to become obsolete.

Excessive Accuracy in Valuation Vitiates Its Timely Value.—If the rates under investigation are unnecessarily high or unreasonably low, the injustice to the public or the company is continued during the period of investigation. It is practically impossible to make refunds or adjustments over past charges, as the company's patrons are constantly changing and the transactions are numerous and involve small amounts. For this reason again the rate determinations should not be extended by needless argument over the theoretical differences of opinion. A rate investigation is more or less a disturbing factor in the company's business. The sooner settled the better, as a rule, so that the correction in rates, if a change is found to be justified, can be made promptly.

After expending time and effort to arrive at an exact valuation, the lapse of time makes it necessary to make allowances all along the line to adjust the findings to the present. After all, the new rates are not expected to be reasonable as to past conditions, but they must be reasonable for future operation.

Assuming that an absolutely perfect determination of value for rate-making purposes has been made, the commission is then met with practical difficulties in the way of fixing the rate on a strict cost-of-service basis. Perhaps the utility is still in the developmental stage and cannot be made to bring in a reasonable return immediately or some other circumstance calls for a modification of the rate finding. Competition is a factor, value of the service must be considered, and judgment must be exercised at every step of the investigation, regardless of all attempts to place rate making on an exact mathematical basis.

Changing Attitude as to Valuation.—It would

seem that now after some ten years of regulation of public utilities a theory and method of procedure would be clearly mapped out, if such is possible of determination, but the subject is still in a confused state. The holdings of courts on various elements of value in taxation cases or in cases where valuations have been made to determine whether or not there has been confiscation of property, and the holdings of commissions in capitalization and purchase cases have been cited in rate proceedings without proper distinction being made. After much discussion on a certain point commissions have failed to state the final conclusion and value used. So in following precedents one comes to blind alleys, many branching off places and puzzling crossroads.

Valuation has been overemphasized, has been made an end in itself. It should be recognized that the commission is not seeking a value, but is seeking a reasonable-rate base. With a value right at hand, a commission will go out around it, add on and subtract from, in order to arrive at a base which in its judgment is proper in that case. Even if the records of a company were absolutely complete, showing the cost of the property just as it was acquired, the cost, or the first cost less depreciation, would not necessarily be taken as the base for rate making.

In the above discussion it is not intended to present an argument for the entire disregard of valuation in rate cases, but for a practical treatment of the work of making appraisals. The commission must make an investigation and get together facts upon which to base an opinion, but it would seem that, with more complete operating records before the commission and greater familiarity of the regulating commissions with the work given them to do, a more practical handling of valuation may be expected than that found in the earlier decisions.

A very marked change has in fact taken place. One advance was made by one commission which secured more co-operation between the commission's engineers and the engineers of the company and the city. The position was taken that the items of property either were or were not there and an inventory of the property was made up which was acceptable to all the parties making the appraisal. Then the proposition was asserted that the property either had a value in a rate case or did not have a value, and they sought to secure a practical co-operation of the various engineers in determining common-sense values which would appear reasonable to all parties for all practical purposes. In this way many of the differences in engineering practice were worked out before the data were presented to the commission.

In other cases, to avoid the costs of making complete duplicate appraisals, the commission's engineers, representing the neutral body, made the only complete appraisal in the case, their findings being subject to check by the city and the company. Or in still other cases the burden was on the company of showing the reasonableness of the rates complained of and a complete inventory and appraisal was required of the company, subject to check by the commission's engineers.

In the case of an application for an increase when the record showed a deficit from operation under the rates in force, the New Jersey Board prescribed new rates and ordered the company to file an appraisal of its property with the Board at a subsequent date fixed in the order, failure to file the inventory cancelling the permission to increase the rates.

More recently, during the war period, much less importance has been given to the determination of value in rate cases. This is true especially of the emergency rate increases, but it is very doubtful indeed if, even after a return to more normal times, valuation will ever be taken as seriously in a rate case as it has in the past. A number of causes have contributed to the omission of extensive appraisals from recent cases.

The rapid increase in prices has made it difficult to determine what should be considered reasonable unit prices for such valuations. There has been a marked withdrawal of engineers from valuation work to construction work or other work in connection with the demands of war. The emergency rate increases needed to meet the sudden increase in costs of operation could not be postponed for complete investigation. And still another reason lies in the fact that in many cases the commission is familiar with the company's financial standing through previous rate investigations, accounting supervision, or supervision of security issues and cases of purchase and sale. Or if not that particular company, the commission has a practical knowledge of other similar companies to serve as a guide.

Recent Opinions as to Importance of Valuation.—The attitude of the various commissions may be shown by the following excerpts from recent opinions.

In the Queens Borough Gas & Electric Co. case, in which the company applied for increases in gas and electric rates, the New York First District Commission in an opinion rendered June 3, 1918, discussed the question of whether or not a valuation of the properties should be required. Referring to the making of an inventory, the ascertainment of proper unit prices, and examination to determine the present condition of the property and the extent of depreciation, the Commission said:

"All of these matters involve controversial elements which mean delay and mean expense; and after all, proof of present reproduction cost, with or without deduction of depreciation, is not an indispensable element in ascertaining whether the quantum of net operating revenue yielded by present rates and expenses affords to the company's investors an inadequate return upon that which the law and the constitution says an adequate return must be afforded. * * * In a time of war, there should be no avoidable expenditure of money, expert skill or materials, which does not serve the purpose of integrating these local agencies in the successful conduct of the war. To require the present depleted valuation staffs of the Commission or company engineers to bend their energies for several months to a reinventory and appraisal of this company's property, at a time when unit prices for construction work and materials are so abnormally high as to be misleading and of little aid in ascertaining 'value for rate purposes,' would seem to involve unnecessary delay, unnecessary expense, and undesirable diversion of labor and skill."

The New York Second District Commission said, in the Empire Gas & Electric Co. case (decided June 11, 1918):

"All parties to the controversy are to be congratulated and commended for taking such action as will enable this Commission to fix emergency rates without a prolonged investigation involving perhaps a valuation of the company's properties in each community and which would be conducted at a time when costs are shifting so rapidly that, whatever time might be taken

as the basis of the calculation, the situation would probably be materially changed while the investigation was in progress."

The Illinois Public Utilities Commission determined rates in the Galva Electric Light Co. case (decided June 4, 1918) without a detailed and exact appraisal of the property being made. The Commission said:

"The valuation of the engineering staff is based upon the original cost of the property. This valuation does not purport to be an accurate valuation of the property and was made by the engineering staff without giving detailed consideration to the costs of each individual item of property. The reason for this method of valuation appears to be the emergency nature of the case and the evident desire to render an opinion as promptly as possible and still present data which represents with reasonable accuracy the property values. The engineering staff testified to its belief that a more careful valuation would not alter the results by more than 5%."

When a large number of applications for emergency increases had to be handled promptly this Commission prepared a questionnaire form which the applicant might fill out, submitting to the Commission the facts in outline regarding the operating revenue and expenses and general condition of the business as compared with the conditions prior to the marked increase in operating costs which were the direct cause of the application for rate increase.

There were many indications of a coming change in opinion, however, before these strictly emergency cases arose.

That the changes in conditions during the time which it would take to make a complete valuation might seriously affect the accuracy of the final figures, is taken into account by the New Jersey Board of Public Utility Commissioners in the New York Telephone rate case. The Board in a decision in that case rendered Nov. 20, 1917, said:

"Since the rates to be prescribed by order are to be operative in the future, it follows that, in the exercise of the power of regulation, past conditions and experience thereunder alone cannot be taken into account. The future and the conditions under which the rates prescribed are in fact to be applied must be considered.

"As was said by Justice Harlan in Smyth vs. Ames (169, U. S. 466), 'the probable earning capacity under particular rates prescribed * * * and the sum required to meet operating expenses are * * * matter for consideration.'

"Especially is this so, where, as here, a long period of time necessarily elapsed in making the inventory and appraisement of the property and in hearings, and consequently the data which form the basis of the exercise of the power relate to a date already some time in the past. In the meantime conditions have materially changed; annual taxes have increased; special war taxes have been and will be imposed; the trend of the cost of labor and materials has been substantially upward; and the proof, in fact, shows that operating expenses have been and are on a steadily ascending scale."

The Supreme Court of Pennsylvania said:

"The ascertainment of the fair value of the property, for rate-making purposes, is not a matter of formulas, but it is a matter which calls for the exercise of a sound and reasonable judgment upon a proper consideration of all relevant facts." (Borough of Ben Avon *et al. vs.* Ohio Valley Water Co.)

After discussing the valuation data submitted in the fare case of the Chicago, North Shore & Milwaukee Railroad Co., the Illinois Commission in an opinion under date of Sept. 5, 1917, said:

"Finally, it must depend upon the good judgment and impartiality of the regulating body which has before it all facts bearing upon the matter. In all proceedings of this nature there will always be found outstanding certain points which will serve as guideposts by which the amount shall be determined that is fair both to the corporation and its patrons. More than this cannot be expected, and justice is satisfied if this be done."

The simplifying of valuation problems through continued regulation of accounts and capitalization is illustrated by the following New York and New Jersey cases.

In the New York & North Shore Traction Co. fare case, before the New York First District Commission, the records as to investment and return were unusually free from dispute for the reason that the company had been continuously subject to commission supervision. The Commission in that case (decided Jan. 7, 1918) said:

"The compactness and convenience with which it was possible to present the petitioner's case in this proceeding, and the absence of confusion or controversy as to the accuracy or significance of the items appearing in the various exhibits submitted to the Commission, may be ascribed almost wholly to the fact that the petitioner's financing, accountancy and operations, except in respect to the sufficiency of its depreciation reserve, have been conducted in conformity to the Commission's rulings and directions. In consequence, it was possible, with little difficulty, to present the petitioner's property costs, operating statistics, revenue needs, and the like, with complete fairness and clarity."

The New Jersey case referred to above is the New Jersey Northern Gas Co. rate case (decided Dec. 19, 1917) in which the Board said:

"In lieu of an inventory and appraisal, the company submitted a table showing its issue of bonds, the net proceeds therefrom and the amount of stock issued at par, which securities were issued under the authority of this Board. It does not necessarily follow, however, that a valuation made *ex parte* for the purpose of approving an issue of securities would be conclusive for purposes of developing a schedule of rates. For the purposes of this report, however, the difference will not be such as to affect the validity of the conclusions which may be arrived at."

Valuations in Capitalization and Sale Cases.—Valuations have been made by commissions in capitalization cases and in cases involving purchase and sale of utility properties. The commissions have held in such cases that the process of valuation is not the same as in a rate case. The purpose for which the valuation is made is controlling. But it would appear that under regulation there should be little difference between the value for a rate case and value as a basis for capitalization or purchase. The earning power of a utility would ordinarily have weight in fixing a purchase price, but the earnings are subject to modification by a commission's order. If the commission approves the purchase of a property at a higher value than the value upon which the company would be allowed a return in a subsequent rate case an injustice will be done. A similar circumstance would arise if securities were issued under commission approval on

a larger basis than would be used in a rate case. Provision might be made for amortization of an excess value capitalized or allowed in a purchase case, or the buyer might be willing to pay a higher price for the property, expecting to improve the property by more efficient management and the working out of economies in operation, trusting that the commission would permit him to share in the resulting benefits. But, as a rule, the approval of a different and higher value in capitalization or purchase cases than in a rate case subjects the industry to an element of instability which is unnecessary under regulation.

There may continue to be cause for uncertainty in the determination of a proper rate base in cases where the company has been established long before commission regulation was instituted, but it is of greater significance to determine the attitude of commissions toward new capital which has been invested in these properties with their approval and where the company's accounts have been open to inspection and regular reports made to the commission. Any uncertainty as to the treatment of this new capital by commissions in rate cases will be reflected in the attitude of capital toward investment in the public utility field and will have much to do with fixing the interest rate which it is necessary to offer such capital for development and extension of these industries.

BASES OF VALUATION IN RATE CASES.

Earning Value.—Commissions have pointed out that earning value cannot be considered in a rate case, for the proceeding is for the purpose of determining what earnings are reasonable.

Market Value.—Market value is not available as a base in public utility cases, as properties do not change hands very frequently as a rule, and under regulation the usual considerations affecting a purchase price are modified by the very fact that the property is under regulation.

Original Cost.—The original cost of a property determined from actual company records or an estimate of original cost built up by the use of unit prices which were probably paid at the time the property was constructed may be used as the measure of value or one of the bases of value in a rate case. When regulation was first established it was seldom possible to find actual cost records. Properties had changed hands, and perhaps the present property was the result of consolidations and original records were not available, but with regulation continued over a considerable period, in the case at least of properties more recently established, complete cost data will be on record.

Present Value.—The present value of the property may be taken as a basis, judged by present-day prices of labor and material necessary in building up the property, the possibilities of development of the business in the field, the adaptability of the property as erected to serve the demands of the community, and the depreciated condition of the property. This value should reflect appreciation as well as depreciation.

Reproduction Cost New.—Lacking exact records, the commissions have built up estimates of the cost to reproduce the property. In some cases the aim has been to determine the cost of an identical property, in other cases the cost of a property planned to meet the present needs of the community. In some cases the estimate has been made using unit prices such as might have gone into the property at the time it was constructed, in others present-day prices have been used, while in others the prices used do not belong to any definite date but are averages covering a number of years.

Actual-Performance Method.—A basis called the actual-performance method was used in a recent case purporting to bring a new angle to bear upon the question of value. The method was used by the Pacific Telephone & Telegraph Co. in presenting cases before the Washington and Oregon Commissions. The Oregon Commission discusses the method as follows:

"The utility has strongly urged the acceptance of this theory, contending it is superior to the 'reproduction-cost method,' which, we believe, all will admit has not proven entirely satisfactory in its application when considered as a determining factor of value.

"The company maintains an elaborate system of cost accounting which is of particular value in investigations of this nature, and by reason of which it is enabled to present this 'Actual-Performance' estimate. Briefly stated, this estimate was made up by an analysis of the entire cost of doing work, including supervision, general and other so-called overhead expenses, as shown by the company's cost records over a period of years, from which analysis unit costs were derived. These unit costs were then applied to the various items of property as shown by an inventory of the system. In the case of land, studies were made to determine the cost of acquisition over and above the price paid the seller, and this cost was added to the value of each parcel as determined by appraisals made by real estate dealers and land appraisers.

"The result, the company contends, is not 'Original Cost,' neither is it 'Book Value,' nor 'Reproduction Cost,' but is rather an 'Appraisement on the Basis of Actual Performance' and presents 'an array of facts as distinguished from an array of opinion, expert or otherwise, that ought to be the recourse for constructive and efficient regulation.'

"The theory commends itself to us very strongly. It embodies many features which are lacking in the reproduction theory and, in a measure, meets many of the meritorious objections to original-cost figures. Taken in connection with original-cost statements and reproduction estimates, it supplies information which is of inestimable value in arriving at a correct solution of a problem which, at best, is surrounded with uncertainties and frought with technical considerations. We do not wish to be understood, however, as accepting this theory as a substitute for the reproduction method. Neither do we think it should supplant original-cost figures. It conflicts with neither, and we are inclined to view this new presentation rather in the light of a valuable addition to those theories which have been accepted as bases for the determination of values."

(To be concluded.)

ANOTHER UTILITY INSTALLING WIRELESS TELEPHONES.

The Public Service Co. of Northern Illinois is installing wireless telephones at its Blue Island and Joliet stations, the intervening distance as the crow flies being only about twenty-five miles. The two stations tie-in together and also are interconnected with the Fisk and Quarry street stations of the Commonwealth Edison Co.

The wireless system will have a radial power of about 100 miles, and will be used primarily during such times as the metallic telephone lines are out of service, due to weather or high-voltage system trouble.

Modern Electric Furnace Practice in Foundries

Advantages of Electric Furnaces — Acid Type of Furnace for Foundry Work—Comparative Operating Costs—Furnaces for Malleable Iron — Abstract of Paper Before A. S. M. E.

By W. E. MOORE

UP TO the present time the electric furnace has seen its largest commercial development, first, in the manufacture of aluminum; second, in the manufacture of steel; third, in the manufacture of ferroalloys, and fourth, in the manufacture of calcium carbide. At the end of 1913 there were only 19 electric furnaces installed in the steel-making industry in America. This number had increased to 136 at the end of 1916 and to 269 at the end of 1917. Now the number of steel-making furnaces in use in various industrial countries of the world is 815, of which 290 are in the United States and 45 in Canada.

The average capacity of these furnaces in America is 0.37 tons per heat for ingot furnaces, and 1.7 tons per heat for foundry furnaces, though the 3-ton size is now most generally used in foundries. More than 99% of all the steel-making furnaces are of the arc type, less than 1% being of the induction type, which was popular in the early days of the art.

Electric furnaces are used for the following principal purposes in the metal industries:

(1) Forging steels, tool steels, alloy steels, etc.

(2) Making steel castings in foundries.

(3) Making high grades of strong cast iron for difficult or fine castings.

(4) Melting brass, bronze and other nonferrous metals.

Properties of Electric Steel.

Primarily, electric steel became popular because of its superior physical properties. While such steel can be made with a more satisfactory chemical analysis, using a given grade of raw materials, than by other processes, experience has abundantly demonstrated that when made according to the same chemical analysis electric steel will have about 15% greater tensile strength or ductility, depending upon its heat treatment, and that it is more resistant to shock and better able to receive heat treatment. The reason for this is that the steel, being made in a closed furnace and in a reducing atmosphere away from the contaminating influences of combustion gases, is more solid, freer from gases and less prone to non-metallic inclusions of slag oxides.

TABLE 1.—COMPARISON OF OPEN-HEARTH AND ELECTRIC-FURNACE STEEL

	Open-hearth furnace.	Electric furnace.
Elastic limit, lbs. per sq. in....	41,060	64,850
Tensile strength, lbs. per sq. in.	89,100	105,140
Per cent elongation in inches..	21.5	22.0
Per cent reduction of area.....	31.74	52.37
Elastic torsion	16,750	33,700
Character of fracture.....	Granular	Silky cup

As an example, the tests in Table 1, made by R. W. Hunt & Co., Chicago, Jan. 30, 1919, for the Chicago Surface Lines, illustrate the physical properties of A. E. R. A. specification heat-treated electric-furnace axle steel. It was heated from 1450 to 1460 deg. F. held 1 hr., quenched in 65-deg. oil, drawn from 1185 to 1200 deg. F. for 1 hr. and then slowly cooled in the furnace. The open-hearth steel was also heat-treated in the same manner.

The Bureau of Standards reports regarding the superior qualities of electric steel as follows: The characteristics of electric steel are great homogeneity and freedom from segregation. It is somewhat higher in tensile strength and elastic limit than other steels, and, owing to its greater density, shows a marked resistance to fatigue.

Being absolutely "dead" when properly made and averaging lower in sulphur, electric steel in the foundry is less liable to show shrinkage cracks between ribs of castings, and, being more fluid, it is not so liable to piping, blowholes, cold shuts or misruns, and in tool steel it takes heat treatment more effectively and will stand greater abuse in heating.

The electric furnace is especially useful for making alloy steels. Since the metal is treated in a reducing atmosphere, there need be no large losses of the added elements, such as silicon, manganse, vanadium and chromium, which in the ordinary open-hearth practice are oxidized in large quantities and carried to waste in the slag, thus producing uncertain mixtures. Indeed, the added elements in open-hearth practice frequently show losses of from 30 to 50%, while in the electric furnace they will be practically nil.

With the electric furnace it is much easier to carry the finishing operation to a more exact limit in carbon and silicon content than is practicable in the case of the open-hearth furnace. Gases of solution and inclusion (oxygen and nitrogen) are eliminated.

Electric Versus Open-Hearth Furnaces.

In open-hearth furnaces it is impracticable to melt down fine scrap, such as turnings in quantity, without excessive additions of pig iron, for the reason that the oxidizing flames, which furnish the heat to the furnace, will reduce the metal when in an attenuated form to a mass of oxide before it becomes molten, whereas with the electric furnace it is entirely practicable to melt turnings exclusively, which, under ordinary market conditions, are purchasable at a price from $5 to $10 per ton lower price than that for the heavy melting grade of steel required in open-hearth practice.

In the electric furnace it is possible to obtain a heat-transfer efficiency of from 60 to 70% of the heat energy of the electric power supply put into the molten charge, whereas with open-hearth practice the efficiency ranges from 8 to 15% and in a crucible practice from 2 to 6%. The fuel-developed heat unit of the open-hearth furnace is, however, bought in a

much cheaper form than the heat unit supplied by electric power, and if the electric furnace did not have the other advantages mentioned it could not at present compete against the open-hearth furnace on the basis of cost.

On account of the very intense heat of the electric arc, it is entirely feasible to melt down and refine a charge of foundry steel in 1 hr. or less which in the open-hearth furnace might require from 6 to 14 hrs. In other words, a 12-ton electric furnace may be practically equivalent to an 80-ton open-hearth furnace, so far as steel output is concerned, and involve far less installation cost.

The Arc Type of Electric Furnace.

The arc type of electric furnace is practically the only one being installed for steel making today, although induction-type furnaces are in use. The induction-type would appear to have advantages over the arc-type furnace, but practice has shown that it is in no way a competitor of a proper constructed arc furnace. In large sizes the power-factor is low, the efficiency poor, and the cost of replacing the refractories high.

Arc furnaces may be classified into long-arc and short-arc types. There are many theoretical inducements for using the long-arc furnaces. With a given energy input, the electrode is correspondingly smaller and the electrode cost therefore reduced proportionately. With the water-cooled bottom-contact type of furnace either the furnace size must be kept small or the voltage must be increased in order to keep the current low and prevent that form of contact from overheating; hence, it is the custom to operate the bottom-electrode furnace with a long arc and low current, and in small sizes only.

Arc furnaces may again be classified into single-phase, two-phase and three-phase types. The single-phase furnace is ideally simple but is poorly adapted to modern power-plant conditions, as central-station power is universally generated and transmitted at three-phase. The long-arc single-phase furnaces have the disadvantage of operating on low power-factor, thus causing waste in transformer, line and generator capacity, which usually makes them prohibitive from the central-station man's viewpoint in any but small sizes, say, ⅛-ton to 1-ton capacity per heat.

The two-phase furnace may be operated from either a two or three-phase source of supply. When operated from the latter it is necessary to use Scott-connected transformers, which are slightly more expensive and inefficient than ordinary transformers. The two-phase furnace is usually built with four arcing electrodes and, while it gives a theoretically balanced load on the power system, it has the objection of requiring an additional electrode, which increases the electrode consumption 33% over the three-phase furnace.

For installations of moderate and large size the three-phase is the most satisfactory, fulfilling all the conditions as to balanced load and high power-factor required by the central stations, at the same time giving the minimum electrode loss and the simplest form of automatic electrode-adjusting gear.

It is possible to obtain satisfactory operation of the direct-arc-type furnace for melting nonferrous metals only where the content of metals which volatilize at low temperatures is small, as, for instance, in making bronze and low-zinc metals. Where the zinc or aluminum content is high, as in yellow brass, Muntz metal, etc., this type of furnace is unsatisfactory and results in great waste of the more volatile metals and the making of porous castings. Consequently special furnaces of the resistor, rocking, rolling, tumbling

Electric Furnaces in Foundry of Standard Steel Co., Hammond, Ind.

induction or distributer-arc types are required, the latter referring to furnaces in which the heat of the arc is transmitted by radiation alone.

Disadvantages of Crucible Furnaces.

The crucible furnace was first used for making steel castings and high-grade tool steels. However, it is now being displaced by the electric furnace, which has the advantages of rapidity of operation, reduced cost and the ability to make sounder castings and better tool and alloy steels. Due to the absorption of carbon from the crucible, it is difficult to make castings low enough in carbon to obtain the ductility desired for many purposes. Furthermore, the steel reduces the silica from the clay of the crucible, tending to run the silicon content of the product high. The overpowering objection to the crucible process, however, is the high cost of the products, due to (1) high cost of pure melting stock, as no refining is practicable; (2) high labor cost on account of the small heats handled; (3) extravagant fuel consumption, sometimes using 3 tons of coal per ton of steel; (4) high cost of crucible renewals, often averaging two to four crucibles per ton melted, and costing $9 to $11 each, or $18 to $44 per ton. For these reasons the crucible process is being discontinued for castings as well as for tool steels.

The Converter Process in Steel Founding.

During recent years the side-blow converter process has become popular in steel foundries making castings of medium and small size. This process requires high-grade, high-silicon, low-phosphorous and low-sulphur pig iron to be melted in a cupola furnace with the finest grade of coke obtainable. The advantages of the converter process are: The steel may be made fluid enough for reasonably thin castings; the heats, usually running 1 to 2 tons, are of convenient size to be poured off quickly before cooling; the fuel consumption is moderate, averaging from 400 to 600 lbs. of coke per ton; the first cost of the apparatus is low, and the process is available for intermittent service.

The disadvantages are: The metal must be handled twice in the ladle; the metal picks up sulphur and phosphorus and nitrides from contact with the fuel and the air blast; the losses in the cupola and converter are quite high, running from 16 to 24%, further concentrating and increasing the percentages of impurities in the original metal and wasting costly melting stock; the steel is full of oxides and gases and requires large quantities of expensive ferroalloys to kill; the quality of the steel physically, as well as chemically, is below par; a heat once blown too cold cannot again be brought up in heat enough to cast and must be "pigged"; only the highest grades of melting stock may be used, costing generally $15 to $25 per ton more than for the acid open-hearth furnace and $20 to $35 per ton more than for the electric furnace; and the refractory maintenance is high, as the cupola and converter linings must be repaired after each 10-hr. run. Liquid-metal costs of converter steel frequently run up to from $60 to $80 per ton.

The electric furnace is the most modern steel-producing agency and is gaining in popularity more rapidly than all others. It is the most compact furnace, and the rapidity with which it will melt down cold charges adapts it splendidly to the making of steel castings as well as forgings and tool steels. It is the cleanest and most certain method of making steel, and its small bulk makes it feasible to locate the furnace near the center of the floor where the metal need be transported short distances only.

Acid-Type Electric Furnace for Foundry Work.

The acid-type furnace is best suited for foundry work and the most popular size has a capacity of 3 tons per heat, though sometimes 1.5-ton or smaller furnaces are required. The more highly powered and rapid furnaces for such work turn out from 8 to 16 heats in 24 hrs. with a power consumption of from 500 to 650 kw-hrs. per ton of liquid steel. Taking the consumption of large turbogenerators now used in central stations at, say, 1.5 lbs. of coal per kw-hr., the fuel consumption of the acid-type electric furnace may be said to be equivalent to from 750 to 900 lbs. of coal per ton melted, and the coal need not be so high grade or low in sulphur and phosphorus as that necessary with fuel-fired furnaces. Basic furnaces require more time and power, heats ranging from four to eight per day, and since the charge is melted in a reducing atmosphere there is practically no oxidation of the metal; consequently thin scrap, light turnings or scrap of other forms that can be conveniently charged into the furnace, may be melted. Such scrap now sells for approximately from $5 to $10 per ton less than low-phosphorous, heavy melting scrap necessary with the ordinary acid open-hearth melting-furnace installation.

The furnace atmosphere, being of a reducing nature, makes it easier to refine and kill the steel, resulting in a saving amounting frequently to half of the ferroalloys necessary with converter steel, effecting a saving of, say, $2 per ton. The melting losses in the electric furnace are much the lowest of any modern process, averaging from 2 to 5 per cent as against 6 to 9 per cent in the open-hearth and from 16 to 24% in the converter process.

The electric furnace does not contaminate the metal as do fuel-heated furnaces and an acid electric will therefore readily make No. 3-U.S.A. specification steel, whereas it nowadays is practically impossible to find melting stock sufficiently pure to do so with the converter process. The saving alone in the cost of melting stock will more than pay for the entire conversion cost of electric steel. The greatest points in favor of the electric furnace are the much higher grades of steel produced and the higher percentage yield in castings and bars.

Comparative Costs of Electric and Converter Steel.

With the electric furnace, men can more readily make and check their steel to an exact percentage of carbon, manganese and silicon and can more easily keep the undesirable sulphur and phosphorus to lower limits than by any other process. The steel may be readily alloyed with nickel, chromium and vanadium to make the higher grades of steel castings to replace forgings and for special purposes such as may be required for cutting tools or parts of unusual strength and ductility. It is entirely feasible to make castings which will run up to an ultimate strength of 130,000 lbs. per sq. in., or to cast high-speed-steel milling cutters and reamers to form for grinding. The figures in Tables 2 and 3 show present-day comparative operating costs for liquid steel in the ladle under favorable conditions such as in a steel foundry under operation 24 hrs. per day.

Reports of a recent test of cupola iron shows a transverse load of 2950 lbs. with a 0.10-in. deflection

in a standard arbitration test bar. After treatment for 25 mins. in an electric furnace, using 104 kw-hrs. per ton, a similar bar was cast and broke at 4400 lbs. with a 0.115-in. deflection.

Good results have been obtained with malleable iron made by treating cupola metal or by melting cold scrap in an electric furnace. The ability to refine for sulphur and phosphorus and to add ferroalloys to adjust the mixture to the proper malleabilizing formula, together with its rapid operation, give the electric furnace a decided advantage in malleable-iron foundries, particularly in working on high-phosphorous southern irons.

TABLE 2.—AVERAGE COST PER TON FOR TWO TONS OF CONVERTER STEEL DIVIDED INTO FOUR CUPOLA CHARGES.

(Two-ton Converter Charge.)

	Cost per ton of liquid steel.
Low-phosphorous pig iron	$14.09
Bessemer pig iron	7.89
Steel scrap	10.14
Silicon and spiegel	5.55
Coke, 863 lbs.	1.01
Cost of material per ton of liquid steel	$38.68
Additions per ton of steel:	
10 lbs. 80% ferromanganese at 6 cts.	$ 0.60
6 lbs. 50% ferrosilicon at 5 cts.	0.30
2 lbs. aluminum at 30 cts.	0.60
Power for blower motors	1.25
Cost of materials and power per ton of liquid steel	$41.43
Average cost of cupola and converter linings	1.20
Labor costs	3.00
Cost of converter steel per net ton in ladle	$45.63

TABLE 3.—AVERAGE COST PER TON FOR THREE-TON ACID-LINED, RAPID-TYPE, POLYPHASE, ELECTRIC FOUNDRY FURNACE STEEL.

(Three-ton Electric Furnace Charge.)

	Cost per ton of liquid steel.
Axle turnings (included above 3% losses, 200 lbs.)	$12.40
Mill scale (included above 60% losses, 60 lbs.)	0.09
Electrodes at 7 cts.	1.40
1650 kw-hr. (550 per ton) at 1 ct. per kw-hrs.	5.50
Losses in melting 260 lbs.:	
80% ferromanganese	0.40
50% ferrosilicon	0.25
Aluminum at 30 cts.	0.15
Cost of material per ton of liquid steel	$20.19
Average cost of linings and roofs	0.40
Labor cost on furnace attendance	1.00
Cost of electric steel per net ton in ladle	$21.59

In the non-ferrous-metal industry the electric furnace has shown remarkable economies, due to the saving of cost of crucibles and the greatly reduced metal losses caused by oxidation and volatilization. For such work special types of furnaces designed to avoid localized heating are necessary.

Selection of an Electric Furnace.

As to the most suitable type of electric furnace for a given installation, if the scrap be inferior and high in sulphur and phosphorous, then the extra cost, slower operation and shorter refractory life of the basic furnace must be endured to obtain the lower limits of sulphur and phosphorous not practicable to reach with the acid furnace using poorer grades of scrap. At present the call is for acid-lined furnaces, and cheap, good scrap is available in large quantities for foundries and basic furnaces for alloy and tool steel. The acid furnace is simpler, cheaper and faster to operate and the steel casts more easily, while the basic furnace is essential for tool steels.

In any case it is recommended that a furnace be so designed and constructed that it is adaptable to basic operation. This means that the furnace shell must be of large diameter and the bath shallow and of large area. The furnace should not, it is thought, be of the long-arc type, nor of the small-diameter, deep-bath type if the best and most rapid work is contemplated. Indeed, even for acid melting there is a noticeable difference in the quality of the steel obtained from the large-diameter, shallow-bath furnaces compared with that made in the deep-bath-type furnace, for with the latter it is not feasible to obtain the same mechanical reactions from the additions put in to refine and kill the steel as when the bath is of the shallower type. Nor is it possible to deoxidize the metal so thoroughly by maintaining a reducing atmosphere in the furnace.

It is quite important that the furnace should operate at the highest practicable power-factor that can be obtained without undue disturbance of the power company's load, for by so doing the electrode, transformer, line and generator losses are maintained at a minimum. Engineering skill of a high order is required to forecast and select the best type of equipment under the many varied power-supply conditions which obtain in different localities.

By reason of the now generally acknowledged superior quality of the product, greater flexibility of operation, quicker and more convenient size of heats, and saving in alloys and in cost of melting stock, the electric furnace is rapidly coming to the front in the steel foundry and alloy- and tool-steel works wherever suitable power is available and progressive policies are in vogue. It is making possible the profitable operation of widely distributed small steel foundries to an extent not generally realized and greatly reducing the investment cost required in tool-steel works.

INVESTIGATION TO BE CONDUCTED OF FATIGUE OF METALS.

Joint Research to Be Made at Engineering Experiment Station of University of Illinois.

An investigation of fatigue phenomena in metals under repeated stress has just been started under the joint auspices of the National Research Council, Engineering Foundation, and the Engineering Experiment Station of the University of Illinois. The Engineering Foundation is providing $15,000 a year for two years for this investigation and the Engineering Division of the National Research Council is acting in an advisory capacity, largely through its Committee on Fatigue Phenomena in Metals. The experimental work is being done in the laboratories of the Engineering Experiment Station of the University of Illinois, under the immediate direction of Prof. H. F. Moore, research professor of engineering materials and chairman of the committee above mentioned.

Plans are laid for a two years' program of tests, and apparatus and material are already arriving for the tests. It is hoped to secure a considerable amount of data on tests of various metals, including a number of tests of each metal to 100,000,000 reversals of stress. It is hoped to study the various short-time physical tests which are used for metals—such as the impact test, magnetic analysis, and short-time bending tests—to see whether any of these tests give reliable indices of the ability of the metal to resist fatigue under millions of repetitions of low stress. It is hoped that some reliable commercial test for this important property may be developed by this investigation.

A test party of four or five persons is being organized and the University of Illinois is fitting up a special laboratory with about 2500 sq. ft. of floor space for the use of this investigation.

Records of Lamp Service in a Large Park System

Lamp Record System Used by the Electrical Department of Lincoln Park Proves Simple and Discloses Interesting Facts Not Only on Lamp Life But Often Also on Apparatus Trouble

By C. H. SHEPHERD

Electrical Engineer in Charge, Electrical Department, Commissioners of Lincoln Park, Chicago.

TO secure satisfactory operation and maintenance of lighting systems for streets, boulevards and parks, for which large, high-efficiency lamps are used, it is necessary to keep complete service records of all lamps installed in order to check the actual average life of the lamps against the guarantee and to determine other important engineering data relating to these units in actual service.

POST No. B-69 — 4th North of Burton Pl, LAKE SHORE DRIVE — TYPE 'C' RECORD

NAME	SIZE	FILAMENT	LOCATION	INSTALLED	BURNT OUT	HOURS RUN
WH	400 C.P. 263 W.	Λ Series	L S D	1-22-15	6-10-15	1121
WH	400 C.P.	" "	"	6-11-15	2-8-16	1511
GE	" "	" "	"	2-9-16	5-27-16	1015 (See Back)
GE	" "	" "	"	5-28-16	9-1-16	823
GE	400 C.P. 240 W.	V "	"	9-2-16	3-20-17	Transfered to B 52
WE	400 C.P.	V "	"	3-21-17	4-1-17	133
WE	" "	" "	"	4-2-17	4-25-17	244
WH	" "	Λ "	"	4-26-17	7-30-17	811
WH	" "	" "	"	7-31-17	10-7-17	951
WE	" "	V "	"	10-8-17	4-14-18	1973
WH	" "	Λ "	"	4-15-18	11-13-18	840

Fig. 1.—Lamp Record Card for a Typical Lighting Post—Reverse Side Gives Explanatory Notes and Supplementary Data.

Close co-operation between the operating and maintenance departments is needed in order to keep such records, but if the record system is not complicated and if the entries on the records are properly systematized so that each man is required to keep only his particular part of the record, a matter that need take only a very small part of his time, the keeping of the records can be made largely automatic. The various parts of the records, although each is made out by a different man, can be easily correlated and made to fit together so that a recapitulation of the complete record can be quickly prepared at the end of each month or year or both, as desired. Each card, sheet or other part of the record system should be kept on file as a check in case any discrepancies are discovered later, but the likelihood of serious errors should be small with a system that is properly conceived.

Outdoor Lighting of the Lincoln Park System.

Before describing the lamp record system of the Electrical Department of the Commissioners of Lincoln Park, the following particulars of its outdoor lighting may be of interest. The Lincoln Park system includes Lincoln Park—the best known large park in Chicago—and five small parks (Lake Shore, Seward, Stanton, Hamlin and Welles), the total area aggregating 630 acres; besides these six parks there are over 22 miles of boulevards, including on the south the world-famous Lake Shore Drive with its connection with Michigan Boulevard, and on the north Sheridan Road connecting with the North Shore suburbs.

For outdoor lighting there are in use 1561 type C Mazda 400-cp., 15-ampere lamps, operating on 18 series, 7.5-ampere, 60-cycle circuits, each with its individual transformer and regulator. For special lighting of bathing beaches, monuments, etc., there are about 300 large-sized special multiple lamps and floodlights ranging from 1000 watts down. The inside lighting comprises about 6500 outlets of various sizes. All the lighting circuits run underground from a centrally located substation in Lincoln Park where energy is received from the hydroelectric system of the Sanitary District of Chicago.

All of the series lighting was formerly done by means of arc lamps, which were changed over to the present type beginning in 1914. The results obtained from the series incandescent units have amply justified the change, the saving in operating costs having paid the cost of the change several times over. The

THE COMMISSIONERS OF LINCOLN PARK
ELECTRICAL DEPARTMENT
DAILY TYPE C. LAMP OUTAGE REPORT — DATE Feb 14 1919

CIRCUIT	TYPE & PL. OF LAMP BURNED OUT	TYPE & PL. OF LAMP OUT	DATE OF BURNED OUT LAMP INSTALLED	LIFE OF BURNED OUT LAMP	LOCATION
Q 80	WH Λ	WH Λ	C 4-21-18	2932	2 S Irving P W of Sheridan Rd
R 49	WH Λ	" " "	K 1-28-19	230	3 N Addison E of
R 9	" "	" " "	K 12-9-18	939	2 N Diversey " "
Q 2		OK	cut out		2 N Entrance W. of Drive
L 23	WH Λ	WH Λ	K 11-8-18	1075	2 S Fountain E of "
N 19	" "	" " "	K 1-2-19	299	1 S Fullerton E of Stockton
N 31	" "	" " "	K 9-30-18	1460	2 N " " "
N 35	" "	" " "	K 1-2-19	299	6 S St James " "
E 54	WE V	" "	K 10-24-18	1569	2 S North W of Dearborn
					LWE 1569
					7 WH 7734

REMARKS South light on ship yard
" Sale at Southport & Diversey Both clusters out
" " Lincoln & " Top " "

Fig. 2.—Daily Outage Record Filled in by Patrolman and Trimmer.

records given below cover 4 years and 8 months of operation since the substitution was made.

Lamp Record System Used.

As the lamps are received from the factory they are given an individual test and all defective lamps

Recapitulation on Five Makes of Type C Mazda Series Street Lamps

Year	"A"		"B"		"C"		"D"		"E"	
	No. of Lamps	Average Hours	No. of Lamps	Average Hours	No. of Lamps	Average Hours	No. of Lamps	Average Hours	No. of Lamps	Average Hours
1915	158	1454	299	1185						
1916	546	2924	1020	1555	87	296				
1917	543	3560	768	1251	1490	987				
1918	108	6102	2218	1276	346	2651	14	4614	126	1279
8 Mos. of 1919	25	6738	403	3109	40	4662	6	1680	560	1541
Total & Average for 4 2/3 Years	1380	3315	4708	1472	1963	1317	20	3662	686	1446

Total Lamps Burned Out in 4⅔ Years 8757
Average Lamp Life in Hours 1731

Fig. 3.—Recapitulation of Life Data Covering 4 ⅔ Years.

rejected, the good ones being placed in storage and drawn out as required for replacement.

When a lamp is placed in service it is designated by the location of the particular standard on which it is placed and recorded on the record card No. 1, which is shown in Fig. 1. On the face of this card is recorded information covering the location, circuit, make, size, filament and salient dates of the installation, while on the back of the card are recorded the electrical data on the compensator or transformer serving this particular lamp, including the ratio of transformation of the unit, the primary reactance, etc. This card is held on file until the lamp burns out or is replaced for any other reason, at which time the closing entries are made on the same line of the card.

All burnouts are recorded on the outage report shown in Fig. 2, which is filled out daily, first by the patrolman, who records the outage, and later by the trimmer having charge of the particular district where the burnout occurs, who records the replacement. These records are made out in duplicate, the original remaining on the operator's file, the copy being taken out in the morning by the trimmer and returned in the evening as part of his daily report. From this report, the operator completes the filling out of the record card, Fig. 1, after obtaining the data on the life of the lamp.

The figures covering the data on the life of the lamp naturally depend on the length of run of the circuit on which the lamp is operating and the length of run, in turn, depends on the time of cutting in and cutting out the circuit each day. This time is entered each day on the daily substation load record, together with such other data as may affect the question. From this record, known as No. 3, the daily length of run is entered on the monthly trimming schedule, No. 4. From the first to the last day of each month, the daily length of run is recorded and a progressive total carried through for each month on the length of run of each particular circuit. Knowing the date of installation of any lamp, and the length of run of its circuit, from that date to the time the lamp is renewed, month by month and also daily, it is apparent that it is a comparatively simple matter to figure up the life of any lamp. The date of renewal and the life of the lamp in hours are then entered on the lamp card, together with the data on the replacing lamp, after which the whole process starts all over again.

Valuable Facts Incidentally Disclosed by the Lamp Records.

While the above processes may, at first sight, appear to be more or less complicated, still the operation of this or any similar system becomes a matter of routine as the men doing the work become more accustomed to it. It has been found that the recording of the performance of each and every lamp, compensator and transformer often results in the discovery of irregularities which would otherwise result in serious losses and which might run on indefinitely before being found out. The equipment necessary to carry on such a system costs very little, the time required to carry it on is dovetailed into the work of the various men in such a way that their other duties are not injuriously affected, and the results obtained more than justify the expenditure from any point of view.

In order to illustrate the nature of the life data obtained from the actual workings of this system, there is presented herewith an annual summary, Fig.

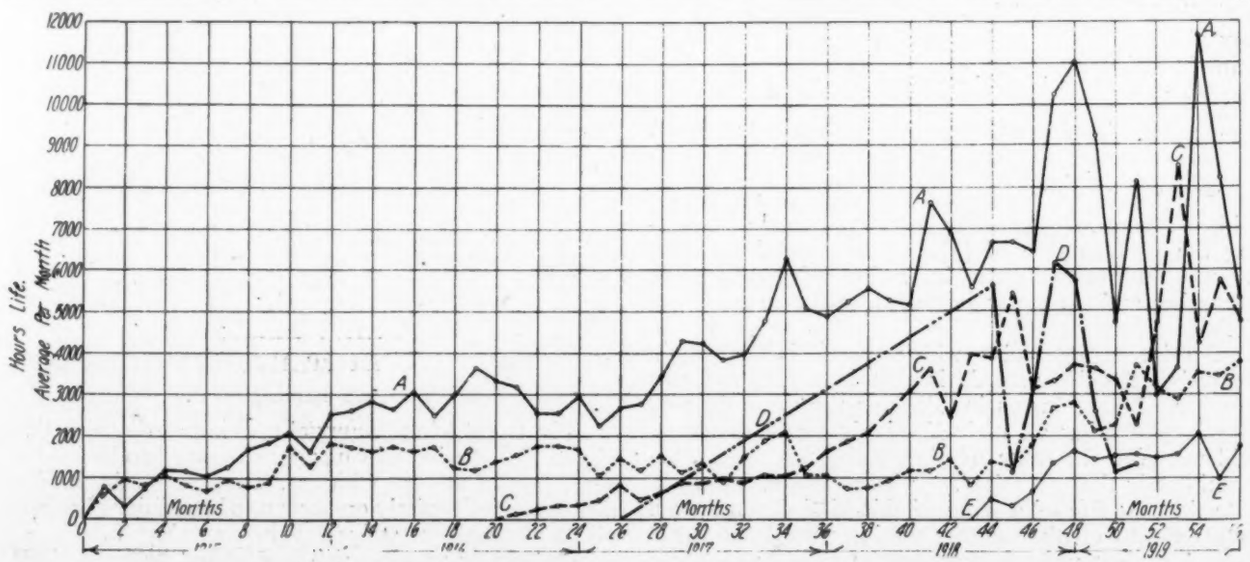


Fig. 4.—Curves Showing Variation of Lamp Life with Time for Five Different Makes of Lamps.

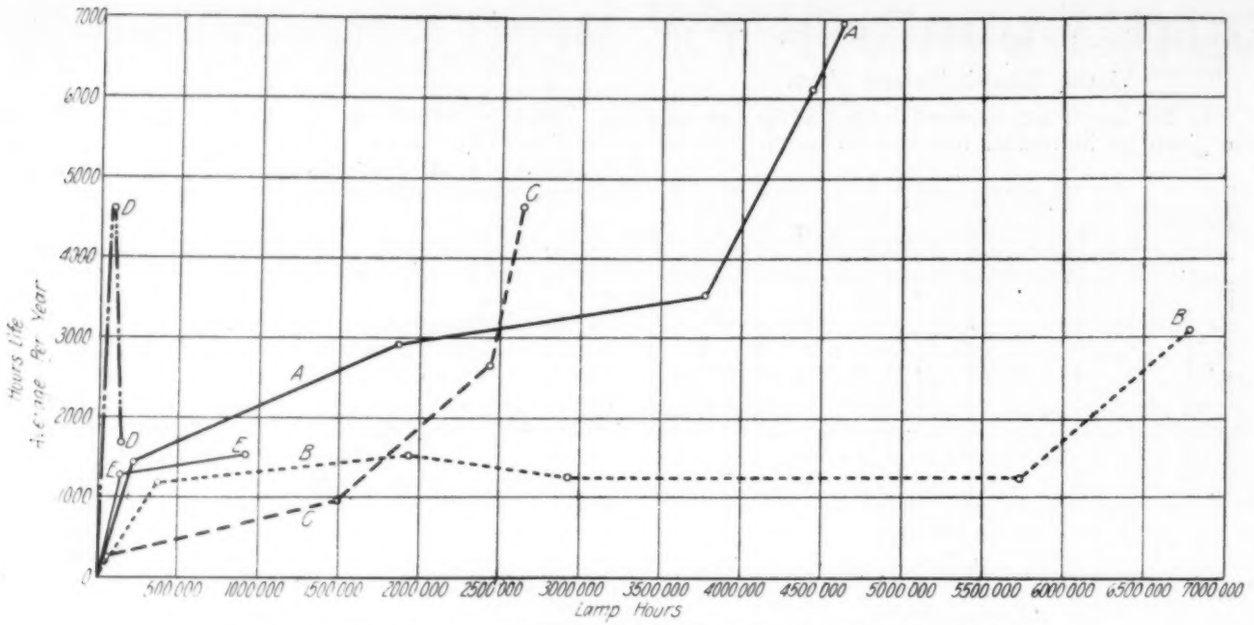


Fig. 5.—Curves Showing Variation of Lamp Life with Increase in Lamp-Hours.

3; from this and the progressive totals covering the number of lamps used, and the corresponding lamp-hours the average lamp life in hours is obtained. The various makes of lamps are designated by the letters *A, B, C, D, E.* From an inspection of the various figures it is evident that the presentation of these data in graphical form would show a number of points which might serve to further the analysis of the subject. For any given make of lamp, assuming a certain number installed and in operation, the short-life lamps of course burn out first as may be seen from the dates, average life and number of burnt out in any given period, under the same conditions. Since the lamps in question have been operated on circuits running all night, or approximately 4000 hours per year; half night, or about 2200 hours per year; and alternately all night and half night, or about 3100 hours per year, all ordinary conditions of operation are represented, all of which tend to maintain a true average. The increasing life under continued operation is also very evident, as well as the variation in periodical burnouts. The record of lamp-hours during any given period supplies a stable basis in the determination of unit costs. Knowing the cost per lamp, the calculating of unit and total costs is facilitated.

Apparatus Troubles Detected from Records—Switching Seems to Affect Lamp Life.

The keeping of apparatus records in conjunction with the lamp records offers an easy method of checking the performance of this apparatus and provides a sure and ever-present indication of any trouble occurring and, in many instances, about to occur on such equipment.

An interesting point which was discovered in analyzing the life records is that in a preponderant number of cases lamps installed on the same date on circuits operating all night, half night and alternate, will not give the same life but will burn out on approximately the same date. This would seem to indicate that the life of a lamp of this kind depends to a larger extent on the number of times the lamp is cut in and cut out perhaps than on the number of hours of actual operation.

Records of this nature are capable of extensive analysis, the amount of which depends on the time available for devotion to the subject. The fact that these records are those of actual operation, under any and every kind of operating condition, makes them especially valuable as an adjunct to the results obtained in the laboratory.

In order to illustrate the variations of lamp life with time and with lamp-hours for the five different makes of lamps used, the curves of Figs. 4 and 5 were plotted, giving a complete graphical record of operation of the units in question for a period of 4 years and 8 months. The seasonal variations are very apparent in the time curves and the plotting of lamp life against lamp-hours (Fig. 5) produces a criterion upon which true judgment of the performance of any lamp may be based. Fig. 3 gives a tabular summary of the lamp-life data of the five makes of lamps used since the beginning of 1915.

REGULATING APPARATUS FOR ELECTRIC RAILWAYS.

A meeting of the Pittsburgh Section of the American Institute of Electrical Engineers was held Dec. 9 at which a paper on "The Power Indicating and Limiting Apparatus for the Columbia and Coast Divisions of the C., M. & St. P. Railroad" was presented by B. H. Smith of the Westinghouse Electric & Manufacturing Co. The paper, which was illustrated by lantern slides, dealt with a new design of apparatus which enables the regulation of the load on 200 miles of electrified road and enables the dispatcher to read at one point the totalized power consumed.

ELECTRICAL CREDIT ASSOCIATION POSTPONES MEETING.

The twenty-fourth annual meeting of the Electrical Credit Association of Chicago, scheduled to be held at the Hotel LaSalle, Chicago, Dec. 11 and 12, was postponed indefinitely on account of conditions brought about by the coal strike. When another date is set for the meeting notices will be sent out by Frederic P. Vose, secretary of the association.

WAR DEPARTMENT'S POLICY RELATIVE TO EXPORT OF SURPLUS SUPPLIES.

Domestic Orders Being Given Preference Over Those from Abroad—Machine Tools Being Sold Here and Also Exported.

The United States War Department authorizes publication of the following statement from the office of the director of sales:

In view of concerted attempts made by certain industries to divert particular surplus stocks of war materials from the domestic to the export market, the director of sales takes this opportunity to state briefly that the sales policy that controls disposition of surplus supplies for foreign consumption.

Full and adequate opportunity is afforded the American public to acquire the surplus supply of each and every commodity and material held by the War Department before attempt is made to dispose of any part of the surplus for export purposes. The export market is developed only for those surplus stocks the supply of which exceeds the quantity that the domestic market is capable of consuming, or for which, because of the manner of manufacture, there is no demand except that existing in foreign markets.

In offering its surplus war materials for sale to foreign governments or peoples, the War Department does not extend to the foreign buyer any terms of sale which are not afforded domestic consumers, except, in a few instances, a period of credit. The exception as to credit is not made to any foreign buyer who purchases with a view to reselling at a profit, but is granted only to distributing agencies which, set up for relief purposes and acting under governmental sanction, provide a channel through which the commodities or materials may reach the ultimate consumer.

The disturbed state of labor and unseasonable weather have seriously curtailed the production of raw materials in the United States, with the result that stocks of both raw and finished products are extremely low in the nation's primary markets. As a consequence, the domestic demand for practically all of the surplus war materials held by the War Department is so strong as to make domestic offers for these stocks more attractive than those which are being received today from foreign countries.

My attention has recently been invited to the pressure that is being brought by members of the National Machine Tool Builders' Association upon members of Congress to have the legislative branch of the Government direct the War Department to attempt to market as large a part as possible of its surplus of machine tools in European countries.

The War Department has a large stock of surplus machine tools. It is attempting to market these tools to the best advantage of the Government and, with this object in view, is offering machine tools for sale both at home and abroad. By contract, dated Sept. 5, last, it sold to Belgian manufacturers, in whose interest the Belgian Government had established considerable credit through American financiers, more than 2500 machine tools, which are now being selected by Belgian representatives and put in transit; it is negotiating with the French Government for the sale of an additional large number of machine tools held by the War Department in the United States. But there is a strong demand on the part of American users of machine tools for certain types of tools of which the War Department has a stock. The American manufacturers need these tools to increase their production and enhance the wealth of the nation. They are willing to pay good prices for those which they desire to acquire. The War Department stands ready to sell its surplus stock of machine tools to these domestic users. It is filling its machine-tool orders in the sequence of their receipt. No machine tool is being held off the market to be applied upon the Belgian contract.

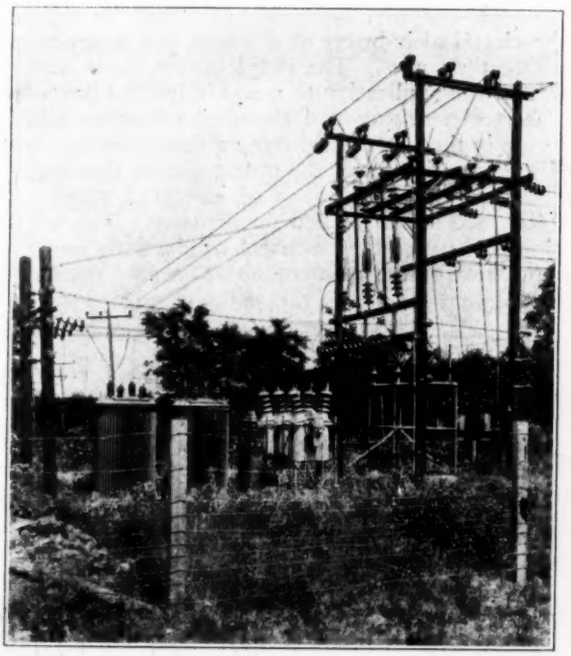
The surplus supplies held by the War Department were acquired with funds furnished by the American people; the War Department proposes to give the American people the opportunity to derive any benefits that may inure to them through the sale of these surplus stocks.

OUTDOOR SWITCHING AND SUBSTATION FOR 33,000 VOLTS.

The outdoor substation installation shown herewith taps a transmission line supplying power to a small town and also controls a 33,000-volt three-phase feeder line to another town at which point a second stepdown substation is located.

A rack near the top of the station supports the three-pole feeder switch and also a three-pole switch controlling two 200-kv-a. 33,000-2300-volt transformers connected in open delta. These switches are operated from ground level by means of an interlocked mechanism with locking type handles. The choke coils are suspended directly in the vertical bus leads, separately mounted horn-type lightning arresters being connected just ahead of the coils.

Overload protection is secured by means of an automatic oil switch and ahead of this are installed



Economical and Simple Construction for 33,000-Volt Outdoor Substation and Switching Center.

three fuses so rated that they will operate only in case of oil-switch failure. This type of installation has many advantages, as it is simple in construction and has a low cost per kilovolt-ampere.

For the above information and illustration we are indebted to H. W. Young, president, Delta-Star Electric Co., Chicago, Ill.

BRITISH ENGINEER ON THE ELECTRICAL OUTLOOK IN GREAT BRITAIN.

Expenditure of $500,000,000 for Construction of Power Stations in United Kingdom Within the Next Five Years Predicted.

J. A. Robertson, addressing the North-Western Center (Manchester, Eng.) of the Institution of Electrical Engineers, of which he is chairman, said it was likely that within the next five years a sum of not less than $500,000,000 would be expended in the United Kingdom upon the construction of new power stations and transmission lines. He said that a small fraction of this amount, say, one-fourth of 1%, expended immediately on research work would prove a thoroughly sound investment. There was still much investigation required regarding the properties of insulating materials for high-pressure cables and generating plant, the corrosion of turbine blading, protective devices for high-tension systems, switchgear to deal with pressures up to 50,000 volts, and many similar problems. Mr. Robertson gave the present cost of super-power station construction as $100 to $110, as against $35 to $40 per kilowatt installed a few years ago; a corresponding increase had taken place in cost of material for and construction of transmission lines.

Referring to legislation, the chairman described the Electricity Supply Bill, which was before the British House of Commons for three days in the last week in November, as by far the most important event in the history of the British electricity supply industry. It was bound to exercise an enormous influence on future developments.

In conclusion, Mr. Robertson said that the outlook for the electrical industry as a whole was never more promising than now. The rapid development during the war of the application to many industrial purposes such as steel smelting and chemical processes which were only in the speculative stage a few years ago had established the future of the industry on a thoroughly sound basis. Manufacturers of electrical plant and apparatus had an unrivalled opportunity. The whole world was waiting for electrical productions and the great problem of the moment was to secure increased output.

ACTIVITIES OF THE SCHOOL OF ENGINEERING OF MILWAUKEE.

The School of Engineering of Milwaukee, Wis., now has 72 members on its faculty board, or more than twice as many as a year ago. It has increased its buildings by the addition of two and its courses by the addition of three. An illustrated description of the electrical courses at this school appeared in the ELECTRICAL REVIEW of March 23, 1918.

The recently organized School of Engineering Branch of the American Institute of Electrical Engineers broke all records for attendance at its first meeting, there being 241 present. This seems to exceed all recorded attendances for initial meetings of similar branches. The school has over 100 fellow members and associates enrolled in the Institute and 257 student members in the student branch. At the meeting referred to Dean John D. Ball presided. W. M. White, consulting engineer of the Allis-Chalmers Manufacturing Co. and president of the Milwaukee Society of Engineers, delivered an address on the subject of "Hydroelectric Development in America."

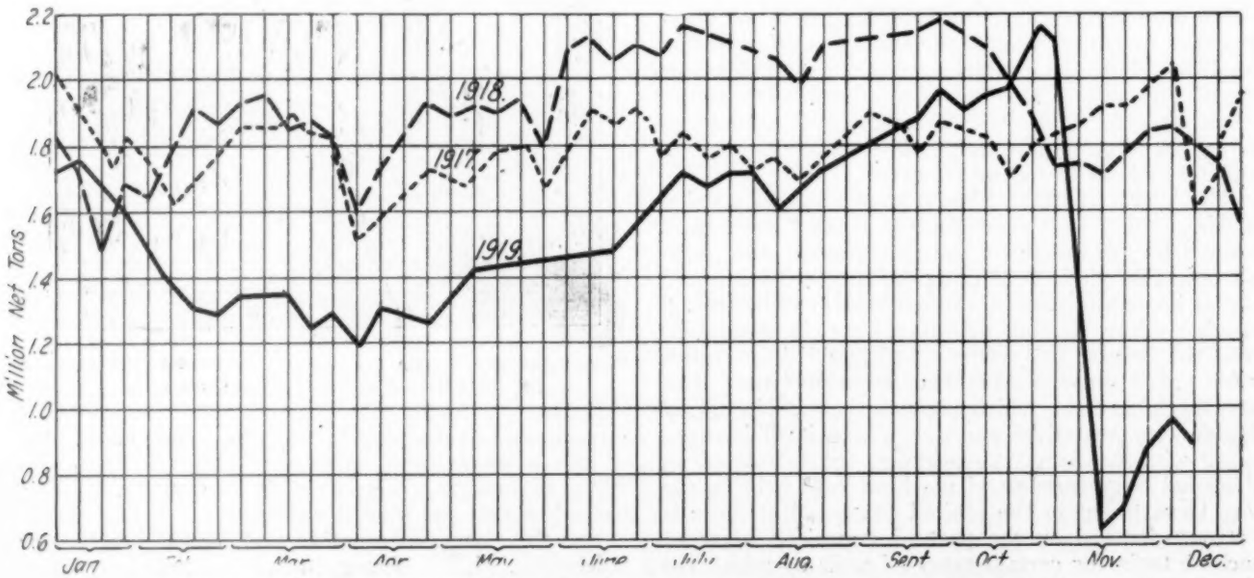
EFFECT OF STRIKE UPON BITUMINOUS COAL PRODUCTION.

The accompanying curves, prepared by C. E. Lesher, United States Geological Survey, show the effect of the strike of bituminous coal miners upon the output of bituminous coal. The annual bituminous production of coal for the years of 1918 and 1917 are also given.

Production during the first week of December—the fifth week of the strike—was 43.5% of normal. The course of the output from week to week has been as follows:

1st week (Nov. 2-8).. ..	29.6% of normal
2nd week (Nov. 9-15)..	33.3% of normal
3rd week (Nov. 16-22)..	44.5% of normal
4th week (Nov. 23-29)..	47.3% of normal
5th week (Nov. 30-Dec. 6)	43.5% of normal

The last week was thus lower than at any time since the first two weeks of the strike. Compared with the fourth week when the wage negotiations were broken off, the tonnage per working day fell off one-twelfth or 8 per cent.



Estimated Average Total Production for Working Day of Bituminous Coal, Including Coal Coked.

Editorial Comment

The End of the Coal Strike

THE great coal strike is over. After cheating themselves out of nearly six weeks' wages, inflicting needless hardship upon the whole country, defying the government and pitting their strength against that of the nation, the miners' union officials have accepted a settlement which could just as well have been accepted without any strike. Moreover, the settlement is so closely similar to the original offer of Dr. Garfield, being only more specific because time enabled it to be made so, that it may be said that the miners' union officials capitulated to the demands of the government.

For this settlement, the American people owe thanks to a few men who performed their duty without fear or favor, who refused to be stampeded by an outcry of powerful forces and who stood aloof above petty politics. Dr. Garfield frustrated a plot to grant increased wages to the miners at the expense of the coal-buying public—although we do not know how long his brave stand will serve its purpose. Attorney General Palmer and Judge Anderson upheld the supremacy of the law. President Wilson, with his gift of clear vision and direct expression, brought added pressure to bear which, with that exerted by threatened proceedings for contempt of court of the miners' officials and lack of income by the miners, combined to bring cessation of the deadlock.

It is well to remember that the strike could undoubtedly have been settled much earlier and in all probability have been prevented entirely. Meanwhile the miners are deserving of steadier work and safer working conditions. The purchase of coal during the off months will do much to bring about the former, while public opinion can do the latter if the facts are properly presented.

Stability of the Central-Station Industry

A SEVERE test has been applied to the central-station industry of the Middle West during the last few weeks, and it has come out of the ordeal not only unscathed but with renewed evidence of its virility. As the coal shortage became more acute, the light and power utilities had to appeal to the public service commissions for permission to curtail their service in less essential lines in order to conserve coal reserves as long as possible for the absolutely essential needs of the communities. On their own initiative some of the leading companies suggested measures for reducing the service and the curtailment thus effected was so severe as to seem almost suicidal to the central-station business. The public responded in full co-operative spirit, although heavy losses were involved thereby to sorekeepers, manufacturers, wage earners and business interests in general. The ffect was extremely impressive visually and depressive mentally, in many cases being more serious than anything found necessary during the war. The question therefore arose, would this depression be more or less permanent in its effect on central-station income?

Last Monday the answer came positively when utility customers, on removal of the fuel restrictions, restored their normal uses of electric lighting, heating and power service. The days of curtailed use of light, heat and power only showed the value of these services from central-station lines. Thus the industry has again shown its firm stability and marked prestige in the public's esteem.

High Tension

HIGH TENSION aptly describes the condition of the times. We are all working at high pitch, at high nervous tension. Everything is at high tension.

In the home, whether the work is done by the housewife or the maid, it is the same story—electrical appliances are taking the place of old-time ways. Things are being speeded up. Labor-saving, time-saving and more healthful ways of doing things are taking the place of manual methods. On the farm, mechanical apparatus is taking the place of man power. Thrashing, milking, plowing, nearly everything, is now being done by machines instead of by men and animals. The farms are beginning to work at higher tension.

Apparatus is being made larger and larger, and more powerful. The large turbogenerators and machines of the waterwheel type, transformers, all machines, in fact, are working at a higher rate of work per unit of weight than formerly, at a greater energy density, at higher tension. Boilers are working at higher rates of evaporation per unit of boiler heating surface than was the case a few years ago. Three and more times as much water is now being evaporated for a given heating surface than was once considered safe or possible.

As was said before, high tension aptly describes the condition of the times. But to be more specific. During the coming year and subsequent years electrical engineers and central-station engineers especially will do well to have before them at all times the term high tension. It is the keynote of many things, the solution to many problems, pressing problems of the hour.

Without high-tension transmission lines, it will never be possible, so far as present knowledge goes, to transmit energy from coal mine to central station by wire instead of transporting chemical energy as coal by rail. Without the high-tension transmission line it would not be feasible to tie-in the distant water power with the market for the electrical energy it is able to produce. The transmission line is the connecting link between water power and the industrial center. Without the high-tension transmission line it would not be practical to link up generating systems, tie-in individual plants and systems so as to co-ordinate their loads, stream flow, and so forth.

California without her high-tension transmission lines would not have been enabled to attain the industrial status she holds today. Her wealth and her prosperity would be very different if she had had to depend upon her oil and costly coal instead of being able to use her vast water power by the medium of the high-tension transmission line. The rural transmission line, at sufficiently high tension for economy —and the tension is a matter of economics at present and not one of materials or of theory or experience—holds one of the greatest promises in the way of emancipation for the farmers and the rural communities. The time may not be quite yet, but the time must come when the farm lighting outfit will be found only where the transmission line cannot go for economical reasons. When that time shall be depends upon the progressiveness or the latent conservatism of the central stations.

Railroad electrification, mine electrification, irrigation and cultivation of swamps, of deserts and waste places, the linking up of water powers, of coal mines with cities, electrification of rural communities and farms, these are some of the things that are urgently awaiting to be done. All are important, some vitally so economically. These are things that are waiting upon the electrical engineer. They are pressing problems, problems of high tension that can be solved by high tension.

Electric Furnaces and Industrial Foundries

FOUNDRIES have not been slow to appreciate the value of the electric furnace, taking into due consideration existing conservatism. They have found that the electric furnace increases the output of the foundry; produces better castings at a lower cost and from poorer quality of metal than former methods, providing the proper precautions are taken; accomplishes a certain degree of refining incident to melting as contrasted to segregating melting and refining; produces more uniform metal; lowers the loss due to variable quality and defective castings and conserves foundry floor space.

With the electric furnace it is possible to obtain a heat-transfer efficiency of from 60 to 70% of the heat energy as compared with an efficiency of 8 to 15% with open-hearth practice, and from 2 to 6% in crucible practice. Heat made other than electrically is so much cheaper than heat produced electrically, however, that the higher heat-transfer efficiency would not permit electricity to compete with other forms of heat were it not for the advantages mentioned above. Elsewhere in this issue will be found an article by W. E. Moore on the electric furnace and the foundry in which is taken up specifically the application of the electric furnace to this industry. Study of this article should prove interesting to everyone; it offers sound talking points to the power engineers seeking to place the electric furnace in the foundries adjacent to their transmission lines.

The electric furnace of the arc type, with its intense heat, is able to melt down a ton of steel and refine it in one hour and less, whereas from 6 to 14 hours would be required if using the open-hearth process. Expressed differently, a 12-ton electric furnace is the equivalent of an 80-ton open-hearth furnace so far as concerns rate of steel output. The saving in labor, in floor space, investment and other incidentals for equality of steel output are in proportion. High rates of steel production per furnace means fewer furnaces and by proper choice of size of furnace great flexibility as well as economy may be obtained by the foundry. With the electric furnace there is little delay incident to starting up for the periodic run such as occurs in the open-hearth and crucible methods of melting. Delays are a minimum, and heat may be taken off or turned on with ease. The maintenance and variation of heat is simple in the extreme.

The foundry offers almost ideal working conditions for the electric steel furnace—ideal conditions when 24-hour service obtains—where the work comprises the production of high grade castings, refining and conversion of scrap into castings. In addition there are many foundries connected with large industrial plants where the installation of an electric furnace for producing castings and melting down the scrap into ingots or castings would bring economy and a better price for junk. For such service as this an electric furnace with its operating characteristics should prove a very good investment in many large industrial plants.

We have become accustomed to look upon the electric steel furnace as apparatus for the large foundry and steel mill. And for this work the electric furnace is the furnace *par excellence*. But it should be emphasized once again, that the smaller electric furnace in the smaller foundry, the foundry of the industrial plant, in the shop of the tool maker and similar trades, opens up a vast field for the manufacturer of electric furnaces, the user of steel and the central station. This field for the smaller electric furnace is not, we believe, receiving nearly the attention it deserves from all so vitally concerned. Why not?

Current Events

Electrical and Mechanical Engineers Discuss Wide Range of Problems — Progress in Solving Inductive Interference

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS TO MEET IN ST. LOUIS.

Fifteenth Annual Convention Will Consider Varied Inspection Problems on Jan. 27 to 29.

The recently issued tentative program for the fifteenth annual meeting of the Western Association of Electrical Inspectors to be held at Planters Hotel, St. Louis, Mo., on Jan. 27 to 29, 1920, augurs well for an interesting and helpful meeting. Men prominent in the industry will discuss the hazard to life and property in the use of electricity, a matter of grave concern to electrical men generally, in view of accident and fire-loss statistics.

A practical way out of the difficulty is being sought by the association. The electrical inspector's responsibility as well as that of the other members of the electrical fraternity will be outlined as clearly and comprehensively as possible. All electrical men interested in the conservation of life and property are urged to be present and participate in the conference. The representatives of all branches of the electrical business will be welcome and extended the courtesy of the floor.

The Western Association of Electrical Inspectors has long recognized that only by co-operation can the perils of the industry be coped with successfully. Those planning to attend should make hotel reservations early. Information concerning hotel rates may be secured from James H. Fenton, Hotel Committee, Pierce building, St. Louis, Mo., or from William S. Boyd, secretary, 175 West Jackson boulevard, Chicago. Prospective exhibitors should negotiate direct with the Planters Hotel for any spaces that may be desired.

A condensed summary of the tentative program is as follows:

Jan. 27, 10 a. m.—Address of welcome by Mayor Henry W. Kiel of St. Louis; reply by Vice-President K. W. Adkins, Kansas City, Mo.; annual address by President C. K. Cregier, Chicago; reports of officers; address by Thos. J. Yeahy, St. Louis, on "The Responsibility of the Public Service Company for Safe Wiring on Consumers' Premises"; address by Chester L. Dows, Cleveland, Ohio, on "The Use of Incandescent Lamps in Dusty Places"; general subject: "Introduction of High-Voltage Current Into Buildings,"—(a) "The Underwriters' Viewpoint," by H. J. Woods, St. Louis; (b) "The Central Station's Viewpoint," by W. H. Millan, St. Louis.

Jan. 27, 2 p. m.—Address on "The Elimination of Conflicts Between the Fire and Safety National Electrical Codes," by A. Waldschmidt, Bureau of Standards, Washington, D. C.; address on "Analysis of Electrical Fire Causes," by Chas. H. Lum, of National Board of Fire Underwriters, New York City; general subject, "Regulating the Electrical Appliance Hazard,"—"The Manufacturer's Duty," by H. J. Manger, Edison Electric Appliance Co., Chicago; "The Electrical Contractor-Dealer's Duty," by A. C. Brandt, Frank Adam Electric Co., St. Louis; "The Central Station's Duty," by speaker to be chosen; "The Electrical Inspector's Duty," by H. F. Strickland, chief electrical inspector, Hydro-Electric Power Commission of Ontario, Toronto, Canada.

Jan. 28, Morning and Afternoon Sessions.—Discussion of inspectors' problems; reports of standing committees.

Jan. 29, Morning and Afternoon Sessions.—Address on "Technical Subcommittees' Work in Revising Motor, Moving-Picture Machine and Garage Wiring Rulings," by F. A. Barron, engineer, General Electric Co., Schenectady, N. Y.; reports of special committees; new business; nomination and election of officers.

A. I. E. E. MEETING DISCUSSES AUTOMATIC TELEPHONY AND SEARCHLIGHTS.

Two Papers Presented at New York by Arthur Bessey Smith and Ralph Kelly.

The 356th meeting of the American Institute of Electrical Engineers was held in New York on Dec. 12. A diversified program was presented which consisted of a paper on the "Applicability of Automatic Switching to All Classes of Telephone Service," by Arthur Bessey Smith, and one on "The Searchlight in the United States Navy," by Lieut. Ralph Kelly.

Mr. Smith's paper was more generally popular than technical. It sought to point out to the audience the practicability of the automatic telephone and the desirability of a more general use of it in these times when operating help is so scarce. The paper showed that automatic switching is uniformly fast and involves reduced mental stress to the user because the passing of the number is positive and waiting time is reduced to the minimum. The life of the automatic apparatus is a matter of speculation, inasmuch as the first automatic apparatus that was installed 15 or 20 years ago is still in service. The apparatus that has been built recently is much more durable and reliable than that in the older installations. A referendum taken among the people who have used both the automatic and the manual apparatus was very largely in favor of the automatic. The difficulty of employing large numbers of people in exchanges is entirely eliminated when the automatic apparatus is installed.

The apparatus that is now being manufactured has been so generally standardized that it is simple to operate and easy to maintain. The amount of training required for those who are employed in maintenance service is not greater than the training required for those who maintain the manual service. Certain parts of the apparatus should be inspected weekly, certain parts monthly and certain parts annually. The tele-

phone, like any other piece of apparatus, requires proper maintenance.

The automatic telephone is adaptable to nearly any condition to which the manual telephone is adaptable. At present the automatic system is being installed in rural communities so that such service may be only a very little inferior to the service obtained in urban communities. Toll switching in an automatic exchange gives the toll operator direct dialing to the subscriber, complete control over the lines, and periodic ringing. The toll network has been improved also by applying automatic switches to intermediate points, so that the originating toll operator can set up the complete connection. Experience during the past 12 years shows that this manipulation increases the carrying capacity of toll lines at least 50 to 100%.

Lieutenant Kelly gave a brief description of the types and uses of searchlights and signaling lights on naval ships. He suggested a changed form of 12-in. incandescent light that will maintain the lamp filament at the focal point of the mirror. The present type of low-power searchlight has many faults. These faults may be corrected by supporting the carbon rigidly near the arc, the positive carbon being held at the focal point by a simple automatic control. The best size and material of carbons should be used regardless of the burning ratio.

The introduction of the high-power searchlight revolutionized the application of the searchlight to naval ships. Although great improvements have been made since the introduction, there is room for a material reduction in the number and complexity of the parts. It is believed also that there is a possibility of considerable improvement in the electrodes.

The use of the dome glass door has extended the possible uses and developments of searchlights. Before this door was used, the concussion of big guns destroyed the flat doors. Lieutenant Kelly said that he knew of no instances in which a dome glass door had been ruptured by concussion. The door enables the searchlight to operate in close proximity to large rifles without harm and makes possible the building of still larger searchlights than those now in use. Star shells have great possibilities, but it is doubtful if they will ever supersede the high-power searchlight.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS HOLDS ANNUAL MEETING.

Election of Officers and Presentation of Many Papers on Many Subjects Features of Successful Meeting.

One of the most successful annual meetings ever held by the American Society of Mechanical Engineers was held in New York City Dec. 2-5. The meeting was notable, not only for the nature and number of technical papers delivered, but also because of the nontechnical aspects of some of the sessions. Instead of devoting the entire program to the discussion of purely technical papers and subjects, those who arranged the program provided a liberal supply of entertainment, opportunity to discuss the political and economic conditions of the day, several excursions, and several functions for the entertainment of the ladies. The technical and nontechnical sessions alternated. Introducing the nontechnical sessions caused an accumulation of papers at the technical sessions which was taken care of by conducting three simultaneous sessions. The most important events on Tuesday, Dec. 2, occurred in the evening, and consisted of the presidential address by M. E. Cooley, election of officers, and conferring honorary membership on two of the most widely known French engineers, Charles de Freminville and Auguste C. E. Rateau. Monsieur Freminville is consulting engineer for the Cruesot Works, and Monsieur Rateau is chairman of the Board of Directors of Rateau, Battu & Smoot Co. of France.

The officers elected are Fred J. Miller, president; John Robins Allen, Robert H. Fernald, and Edward C. Jones, vice-presidents; Elbert C. Fisher, Dexter S. Kimball, Earle F. Scott, and L. E. Strothman, managers; and William H. Wiley, treasurer.

The program for Wednesday included a business meeting in the morning, technical sessions in the afternoon, and the De Lamater-Ericsson Memorial celebration in the evening. The technical sessions of the afternoon consisted of three parallel sessions in which the subjects discussed included appraisal and valuation, aims and organization, and gas power. The appraisal and valuation section met in conjunction with the American Society of Refrigerating Engineers.

The principal matters to come up at the business meeting in the morning was the memorial to Frederick Remsen Hutton, who served as secretary of the society for 23 years. At the end of his service as secretary and coincident with the removal to the United Engineering Society's building, Professor Hutton resigned his position as secretary. He was made president for the year 1906-7. In 1908 he was elected honorary secretary, a distinction which he held until his death.

Greater efficiency in appraisal and valuation methods was urged in the session considering appraisal and valuation which met in joint session with the American Society of Refrigerating Engineers.

David H. Ray, consulting engineer, read a paper on appraisal and valuation methods in which he pointed out the unfairness of some methods of valuation of public utilities and industrial plants, and urged that better plans be adopted for allowing for fluctuating values. He cited instances of extravagance and waste in estimating the value of war plants that are being dismantled and showed how the application of common sense would reduce greatly the cost of such work and would yield satisfactory results.

Other papers read at the appraisal and valuation session included one by George E. Wells, entitled "Ice-Plant Depreciation"; one by John E. Starr, entitled "Depreciation of Insulators"; one by James Rowland Bibbins, entitled "Fundamental Principles of Rational Valuation"; one by Cecil Elmes, entitled "Price Levels and Value," and others.

In the gas power session, E. B. Blakely, of Chicago, described the new Hvid engine. Other papers read at the gas power section included one by L. T. Seaton, entitled "Kerosene as Fuel for High-Speed Engines"; one by Leon Cammen entitled "Combustion of Heavier Fuels in Engines of Constant-Volume Type and Super-Induction Type Engines"; and one by S. A. Sulentic, entitled "Oil Pipe Lines."

The evening session consisted of a joint meeting to commemorate the 80th anniversary of the beginning of Capt. John Ericsson's work in this country, and the 30th anniversary of his death; and of Cornelius H. De Lamater, founder of the De Lamater Iron Works, at which Captain Ericsson's most important work was executed.

The night session consisted of addresses by Lewis

Nixon, Public Service Commissioner of New York City; Rear-Admiral Bradley A. Fiske, and W. A. F. Ekengren, Swedish Minister at Washington; and of a musical program by the Swedish Singing Society.

The Thursday sessions consisted of a morning session in which the industrial situation was discussed, three parallel afternoon technical sessions, and a one-hour session in the evening at which matters of aviation were discussed. This discussion was followed by a social gathering and reunion for members and their guests.

The speakers at the morning session included Frederick P. Fish, chairman, National Industrial Conference Board; A. L. De Leeuw, consulting engineer; William L. Leiserson, chairman of the Labor Adjustment Board of the Rochester Clothing Industry, and Ralph E. Heilman, dean of the School of Commerce of Northwestern University, Chicago.

Frederick P. Fish, in a paper on "The Cause of Industrial Unrest," declared that on the whole and individually the efficiency and productive power of American workmen is less now than it was before the war. In one plant he found that wages had increased 110% since 1914, although the cost of living has increased only about 75%. The manager of the plant was convinced that the efficiency of the individual workman had been reduced 40% since 1914. He expressed the opinion that there could be no cure for the present evils until personal antagonism between employers and employes is eliminated and is replaced by a fair, cordial, and sympathetic co-operation. Every employer should come in personal contact with his employes or should work out a plan that would be equivalent to personal contact. The speaker said that it is of vital importance that the unions should be held to their legal obligation to carry out the agreements that they make.

A. L. De Leeuw, in his paper on "Wage Payments," called attention to the fact that the main terms in controversies between capital and labor are not satisfactorily defined or are not defined at all. The present system of wage payment provides for time given whereas it should provide for work produced.

Mr. Leiserson spoke on "Systems for Mutual Control of Industry."

Professor Heilman, who discussed the possibilities of profit sharing in industry, showed that profit sharing applies more properly to salaried men than to wage earners. He does not think that profit sharing by wage earners is feasible. His reasons for this belief are that the wage earner usually sells labor, an item that cannot be measured definitely; that the wage earner is not in a position to see the advantage of increasing production; and that wage earners are in such large numbers and of such varied degrees of productivity that any system of profit sharing would be difficult to apply. In his investigations he has found instances in which profit sharing has been abandoned in the case of wage earners but he has never found an instance of its abandonment for salaried employes.

Hon. George M. Barnes, member of the British Joint National Labor Conference, stated that within his years of experience labor had risen from a position of illiteracy to a position of well-advanced intellectual attainment.

The program for Thursday afternoon consisted of three parallel technical sessions devoted to machine design, power machinery and textiles. Charles de Freminville opened the machine design section with a discussion about the reliability of materials and mechanism of fractures. He showed that fracture originates internally and that it flows like water or liquid. His illustrations of fractured surfaces showed waves similar to waves of water caused by disturbances in a pond.

His paper was followed by one by W. J. White describing the pumps used to dredge the inner harbor navigation canal at New Orleans. The paper was read by Professor Gregory in the absence of Mr. White. Other papers read at the machine design section included one describing a perfected high-pressure rotary compressor, by C. B. Lord; one on turbo-compressor calculations, by A. H. Blaisdell; and one describing a new type of hydraulic-turbine runner by Forest Negler. Papers read at the power machinery section included one describing the Emergency Fleet Corporation water-tube boilers for wood ships, by F. W. Dean and Henry Kreisinger; one on the flow of water through condenser tubes, by William L. De Baufre and Milton C. Stuart; one on air pumps for condensing equipment, by Frank R. Wheeler; and one on thermal conductivity of insulating and other materials, by T. S. Taylor.

Thursday evening session was limited to one hour in order to provide time for the usual social evening and dance that is arranged for the members and guests. The topic discussed at the session related entirely to aviation—two papers, one by Col. E. A. Deeds, on the future of aviation, and another by Col. Thurman H. Bane, on the present development of the military airplane.

The formal program ended on Friday noon with the close of the three parallel sessions, at one of which matters on transportation were considered, at another of which under the auspices of the subcommittee on machine-shop practice matters relating to machine shops were considered and at the third of which general technical matters were discussed. The afternoon was devoted to the council meeting, and the evening to the college reunions which have come to be an important part of the program.

Papers presented at the transportation session include one on scientific developments of the steam locomotive, by John E. Muhlfeld, and another on motor transport vehicles for the United States Army, by John Younger. Mr. Muhlfeld discussed the scientific factors that have been considered in the design and development of a new, high-power, freight locomotive for the purpose of increasing the average thermal efficiency, as well as the maximum and sustained drawbar pull and horsepower per unit of weight. These factors now are limited by the capacity of the generally adopted boiler superheater. Mr. Younger presented a discussion of the types of vehicles best adapted to various military needs. He showed that motor transport vehicles have been classified by the army into 10 general groups, ranging from the motorcycle to the 5-ton truck. He illustrated his paper with slides showing photographs and tables.

In the machine-shop section papers were read by C. H. Bierbaum, on common errors in designing and machining bearings, by H. R. Trotter, on lubrication of ball bearings; by B. F. Waterman, on thread forms for worms and hobs; and by H. L. Unland, on electric arc welding.

Papers presented at the general session included one by H. A. S. Howarth on slow-speed and other tests of Kingsbury thrust bearings; one by Alfred

Watkins on octaval notation and the measurement of binary inch fractions; one by W. E. Moore on modern electric furnace practice; and one by Alfred Musso on an investigation of strains in the rolling of metal.

Several excursions were provided for the members. These included a visit to the 74th street plant of the Interborough Rapid Transit Co., on Wednesday; an inspection of the power plant in the Equitable building on Thursday morning; one to the Brooklyn Navy Yard on Thursday afternoon; and an inspection of the Curtis aeroplane plant and flying field at Garden City, L. I., at which exhibition flights were given and an opportunity was provided for the members to make flights.

Various excursions and social functions were arranged throughout the week.

ELECTRIC POWER CLUB HOLDS SEMI-ANNUAL MEETING.

Nearly a hundred members of the Electric Power Club were present at the semiannual meeting of the organization held at Hot Springs, Va., Dec. 11-13. The sessions during the three days were occupied chiefly with reports of committees and sections.

At the meeting held last May plans were adopted for creating sections for dividing up the work of the organization according to the class of products manufactured. The reports submitted indicated the work done in establishing these sections and outlined the working plans to be used by the different sections.

James Burke, of the Burke Electric Co., Erie, Pa., president of the club and who was one of the delegates to the International Technical Commission, addressed the meeting on conditions affecting foreign trade. Mr. Burke recently returned from Europe and commented on the European demand for motors and other electrical apparatus.

W. G. Merritt, of the League for Industrial Rights, outlined the work of that organization regarding relations between employers and employes, and explained the League's plans, which were indorsed by the Electric Power Club.

Three new companies were elected to membership, these being the Union Electric Manufacturing Co., Milwaukee, Wis.; Marble-Card Electric Co., Gladstone, Mich., and Sangamo Electric Co., Springfield, Ill.

DENVER MEETING OF N. E. L. A. INDUCTIVE INTERFERENCE COMMITTEE.

The second meeting this season of the Inductive Interference Committee of the National Electric Light Association was held in Denver, Colo., on Dec. 1 to 3. The meeting was well attended by members from many parts of the country, with a specially liberal proportion of western representatives owing to the geographical location.

Some of the sessions were devoted to a continuation of the attention given at the Chicago meeting in September to organizing for the work in hand, including the establishing of a centralized agency to assist power companies to effective co-operative effort and a better understanding in meeting the difficult problems of the inductive interference situation—a situation continually increasing in proportion with the rapid multiplying of power and communication circuits.

Other sessions were given to subcommittee work in analyzing and compiling information gathered pertinent to the situation, and to consideration of requests from several localities for advice in meeting specific and active inductive-interference problems.

The discussions lent renewed emphasis to the committee's realization of its need for thorough support from the power companies, at this stage, by contributing information of their experience and methods of meeting the problems of this kind encountered.

The chairman of the committee is A. E. Silver, of the Electric Bond & Share Company, 71 Broadway, New York City.

NEW YORK ENGINEERS' CLUB DAMAGED BY FIRE.

Early in the morning of Dec. 13 fire broke out in the kitchen of the twelfth floor of the New York Engineers' Club building, 34 West 40th street, New York City, imperiling a number of employes in the servants' quarters close by, disturbing about 350 members sleeping in the guest rooms of the club, and doing damage to the furnishings, etc., estimated at about $100,000. The auditorium and library of the club were severely damaged by water and the eleventh, twelfth and thirteenth floors were badly gutted by the fire.

For a time the fire threatened the Engineering Societies' building directly back of the club and fronting at 29 to 35 West 39th street. By skillful work of the firemen, however, this structure was saved from practically any damage.

MARCONI FUND FOR ITALIAN WAR RELIEF.

In connection with the general work of the Italian War Relief Fund of America, a special fund in honor of Marconi is being raised by an electrical committee of which the members are T. C. Martin, chairman, Dr. Elihu Thomson and J. W. Lieb. Considerable success has attended this laudable effort and the Marconi Fund has already reached over $3500, and a first installment of $2500 has been forwarded to Senator Marconi in Rome for Christmastide.

In view of the fact that sore distress in Italy deepens as the winter advances, it is believed that many others in the electrical field, as well as outside it, would like to embrace this opportunity presented by the special fund. The committee therefore renews its plea for aid and co-operation.

Each subscription is accompanied by an autograph card, with the object of assembling all these cards later in a memorial album to be delivered to Mr. Marconi. Such cards can be obtained from the committee whose address is 29 West 39th street, New York City.

GOVERNMENT TO DISPOSE OF LARGE QUANTITIES OF CABLE AND WIRE.

Announcement has been made by the Director of Sales, War Department, Washington, D. C., that a total of approximately 1,710,000 ft. of telephone cable and 854,923 lbs. of copper wire, packed as originally prepared for overseas shipment, is available for purchase and that proposals for this purpose will be considered. It is understood that the greater part of the wire and cable is located in the Philadelphia Ordnance District.

Commercial Practice

Electricity in Tissue-Paper Manufacture—Central-Station Power in Great Demand—Ohio Inspection Order Rescinded

CENTRAL-STATION POWER FOR MAKING TISSUE PAPER.

Description of Processes of Manufacture and of Electrical Equipment of California Mill Supplied With Energy by Southern California Edison Co.

Within the past few years the paper manufacturing industry in the Pacific Coast states has reached important proportions. Paper manufacturers found that plants operating on the Pacific Coast have a large and growing market at its doors, while wood pulp, produced principally from spruce and hemlock and used as a base for the better grades of paper for commercial purposes, can be obtained from Oregon, Washington or British Columbia and delivered to any part along the Pacific Coast at water transportation rates.

Prior to 1917 California growers of citrus and deciduous fruits depended upon eastern manufacturers for their supplies of tissue paper for wrapping fruits. Hundreds of cars of paper were shipped into California annually for this purpose. Early in 1917 the California Tissue Mills was organized at Vernon, Cal., to manufacture tissue paper to meet the requirements of the fruit growers and for wrapping other foods such as bread and candy.

The new paper mill uses central-station service from the lines of the Southern California Edison Co. *Edison Current Topics*, the monthly publication of the company, gives the following description of the manufacturing processes and electrical equipment in the mill.

Two kinds of pulp are used—"sulphate," from which anti-tarnish and kraft papers are made, and "sulphite," from which tissues and other lightweight papers used in packing fruit are made. The wood is reduced or "digested" to a pulp by chemical process; that is, cooked under steam pressure with sulphuric acid in the case of sulphite pulp and with soda ash in the case of sulphate pulp.

The first process in the manufacture of paper from the raw pulp is "beating." The pulp is put through a vat or tub with a large roll cylinder grinding on a bed plate with horizontal knives under which the pulp passes repeatedly until it is sufficiently reduced. Coloring, if desired, is added in the beaters. The pulp is refined by passing it through three or more Jordan refining engines, which are powerful centrifugal churns, conical in shape, with knives revolving among other knives. The result of this refining is to brush out and separate each individual fiber, thus imparting additional strength to the paper.

The pulp, having been diluted with approximately 90% of water, is then flowed out onto a wire cloth conveyor. This conveyor is an endless copper screen cloth of 90 meshes to the inch, which travels from the pulp vats to the dry end of the paper-making machine. In the process of flowing on the wire conveyor, most of the water is removed by filtration and by suction pumps until at the ends of its travel the thin film of pulp remaining on the conveyor has been well formed and is ready for the pressing and drying process.

At the end of the wire conveyor the paper is delivered to a felt or woolen conveyor which takes the sheet from the wire conveyor and by means of heavy rollers under pressure squeezes the remainder of the water from the sheet of pulp and conveys it to the drying cylinders. The dryers are large horizontal cylinders, steam heated to a high temperature, over which the paper passes in much the same manner as mangles operate in a steam laundry. The paper is then passed off the paper machine, being wound up into rolls where it is ready for cutting up for waxing or printing, as the case may be.

Paper manufacture requires a heavy consumption of power. Continuity of service and constant speed are two important essentials. Electric motor drive, operated by central-station power, relieves the paper manufacturers of an investment in steam-engine equipment, together with its inherent trouble and expense. Motor drive makes higher operating speeds possible because of easier and quicker control, and higher operating speed means greater production.

The California Tissue Mills started with a 100-hp. steam engine and 160-hp. in motors operated by energy supplied by the Southern California Edison Co. In January, 1917, 232 hp. in motors were added, and in August, 1919, 361 hp. in motors were added, making a total connected load at the present time of 753 hp. During the year ending in June, 1919, the load-factor average was 77%, indicating a favorable power-factor and a heavy off-peak load.

Service is supplied from the Vernon substation over three No. 00 wires at 2400 volts, a distance of approximately 4600 ft. This line is used exclusively by the California Tissue Mills and is protected in the substation by an automatic oil switch with a time-limit device set for approximately 5 seconds at 43% overload at normal demand. A similar switch is provided on the primary side of the transformers at the mill with a time-opening device set for approximately 40% overload. Three 250-kw. transformers are used to deliver power to the California Tissue Mills board at 440 volts.

There are 15 induction motors in the mill. The four largest motors are rated at 250, 150, 100 and 75 hp. capacity each. Grid resistances are used in connection with motors where a slight variation of speed is desired.

An interruption to service stops the paper machines with paper on the drying cylinders, where it bakes and makes it necessary to wash up, a loss of over an hour for each paper machine. This circuit is watched very carefully and every effort is made to give an uninterrupted and satisfactory service, which in the past has been done with a high degree of success.

ENLARGEMENT OF CENTRAL STATIONS NECESSARY IN NEAR FUTURE.

Big Demand for Central-Station Power by Industrial Plants Taxing Capacity of Generating Stations and Calling for Extensive Construction.

A good summary of the power situation and its effect on the manufacturing and electric central-station industries is presented in a recent issue of the *Wall Street Journal,* which is noted for being exceptionally well informed on financial, industrial and public utility conditions. It reports that: "Electrical engineers say the demand for power is far in excess of capacity of central generating stations and the electric power companies of the country must add materially to their plant capacity to meet the requirements of industrial companies.

"This situation has been developing since early last summer. The slowing up in industrial activity after the armistice was reflected in a decreased power demand, but now consumption is greater than ever. Plants which were on priority lists during hostilities are now using as much electrical energy as during the war and added to this is the demand from those nonessential industries whose activities were curtailed during the war.

"The use of central-station power has grown tremendously in the last five years as manufacturers generally realize it is more economical than producing their own power. The result is that practically all new plants and most of the old ones not using central-station service want power which generating companies find impossible to supply.

"Central stations in the large industrial centers of Michigan, Ohio and Pennsylvania have experienced a rapid growth. An Ohio plant had one industrial consumer in 1912 using a 50-hp. motor. The manufacturers of the town now use 75% of the production of a 15,000-hp. plant, one factory alone consuming more power than is required for residential lighting in a city of 100,000 population. The Metropolitan Edison Co., at Reading, Pa., a subsidiary of General Gas & Electric Co., doubled its plant capacity to 50,000 kw. during the war and now finds further additions are necessary to supply the needs of its industrial consumers. In 1913 the plant's capacity of 13,500 kw. was only half used.

ORDER ON INSPECTION AND SAFETY SWITCHES HELD IN ABEYANCE.

Ohio Fire Marshal Rescinds Order Requiring Inspections Before Service Is Connected—Also Order Requiring Use of Inclosed Safety Switches.

Electrical contractors and central-station companies will be interested in a notice sent out Nov. 21 from the office of fire marshal of the state of Ohio holding in abeyance recent orders from that office requiring inspection of all wiring before current is turned on and installation of inclosed safety type main service switches.

The notice will relieve the embarrassing situation in which most of the Ohio central-station companies found themselves by reason of the former order. In very few of the municipalities is there any provision for inspection of wiring, and to place this burden on the utilities was considered unfair from the cost standpoint and dangerous from the legal standpoint of creating liability in case anything should occur after the risk is connected. If the law should be made to hold companies for fires that might occur on consumers' lines by reason of defective wiring, it would drive central-station companies in the country out of business; not that so many fires occur from this cause, but the unthinking public charges up to electric wiring every fire the origin of which is uncertain. There is no question but what some action should be taken to counteract and bring about truthful statements in this particular.

It was stated the order pertaining to service boxes would not be seriously opposed by the central-station companies if the order was made so that boxes can be easily and cheaply purchased. Companies look with suspicion and possibly opposition to devices, the cost of which will deter people from the use of electric service. Wiring is essential to the marketing of their output, but no company will object to appliances that will make such wiring safe for the consumer. The principal objection to the recent orders was the inspection, of which no company cared to assume the responsibility or cost.

KENTUCKY UTILITIES FORM BUREAU OF INFORMATION.

Utilities Get Together and Form Bureau for Giving Publicity to Utility Affairs.

The electric light, gas, telephone, traction and water utilities of Kentucky have organized the Kentucky Committee on Public Utilities Information. The purpose of this committee is to give publicity to utility affairs, and in this way bring the utilities and the public closer together and develop a better understanding. It is a combined effort to place their "after war" case directly in the hands of the public, to whom the utilities are responsible and to whom they look for existence and support. The intention is to make known to the public the facts as affecting the service and credit of the utilities and the necessity of the public supporting such utilities so as to enable them to give to the public the best service possible and equal to the needs of every community that is served.

The office of the committee is at 215 West Oak street, Louisville, Ky., and the name of the official organ is the "News Service Bulletin."

CREDITABLE PERFORMANCE OF METER INSTALLING.

Since July 1, 1067 new meters have been installed in the Long Beach district of the Southern California Edison Co. Approximately 1000 of these were installed in individual residences. On the basis of 250 working hours per month, the above is equivalent to an average of one dwelling completed every hour. Monthly gain of meters set during the past four months shows July, 237; August, 234; September, 283, and October, 312. The number of meters in operation on Oct. 31, 1915, was 12,575; in 1916, 13,443; in 1917, 13,929; in 1918, 15,489, and in 1919, 17,746.

ELECTRIC SERVICE FOR PRODUCTION OF OXYGEN.

Large quantities of oxygen are used in Detroit for welding and other purposes, as can be deduced from the report there were used from the Detroit Edison Co.'s system 8,117,850 kw-hrs. during the year from October, 1918, to October, 1919, for the commercial production of oxygen.

Operating Practice

Transmission Line Data—Rearranged Baffling Improves Boiler Operation—Data on Cleaning of Condenser Tubes

DATA ON COSTS AND LOSSES OF CANADIAN TRANSMISSION LINES.

Interesting Data on Some of Canada's Long and High-voltage Transmission Lines.

In the accompanying table is shown the costs for constructing some of the chief transmission lines in Canada. The year during which these lines were built is given in the second column of the first table,

COST DATA OF TRANSMISSION LINES.

Line.	Year built.	Length, miles.	Voltage.	Cost per mile.	Remarks.
Canadian Light and Power Co., Montreal	1911	27	44,000	$11,000	2 circuits of 2-0 copper, steel towers.
Laurentian Power Co., Quebec.	1916	24	50,000	6,875	2 circuits of 1-0 copper, steel towers.
Shawinigan Water & Power Co.	1902-10	550	50,000	1,500	Single circuit, aluminum, wooden poles.
				3,500	2 circuits, aluminum, steel towers.
" "	1910	94	100,000	7,500	2 circuits, aluminum, steel towers.
Sherbrooke Municipal	1917	30	45,000	2,334	Single circuit, No. 4 copper, wooden poles.
Hydro-Electric Power Commission, Niagara system	1907-13	325	110,000	14,000	2 circuits 4-0 and 3-0 copper and equivalent aluminum, steel towers.
" "	1907-13	765	26,400 and under.	2,200	Single circuit, aluminum and copper, wooden poles.
				3,000	2 circuits, aluminum and copper, wooden poles.
Muskoka system.	1915	26	22,000	2,025	Single circuit, No. 2 aluminum, wooden poles.
St. Lawrence system	1913-15	60	26,400	2,458	Single circuit of 3-0 aluminum, wooden poles.
Kamloops municipal	1916	42	44,000	1,667	Single circuit of No. 2, aluminum, wooden poles.
West Kottenay Power and Light Co., Rossland, B. C.	1897-1905	170	60,000	4,000	Single circuit, 92,000 c.m. copper, wooden poles.
" "		32	20,000	2,000	2 circuits, No. 2 copper, wooden poles.

an important factor, since the cost of everything has so risen during the last few years.

In the table of line losses it is interesting to note that of the 11 transmission lines tabulated, the average length is about 52 miles and the average line loss is approximately 11.4%.

LINE LOSSES.

Name of company.	Termini.	Voltage at generating end.	Distance, miles.	Loss, per cent.
Shawinigan Co	Grand'mère to Montreal.	100,000	94	10
Can Light & Power Co.	St. Timothée to Montreal	44,000	27	8
Laurentian Power Co.	St. Féréol to Montmorency	50,000	24	5
Sherbrooke Municipal	Weedon to Sherbrooke	45,000	30	13
Hydro-electric Power Com.	Napanee to Kingston	44,000	30	10
Toronto Power Co.	Niagara Falls to Toronto	60,000	80	20
Dom. Power & Traction Co.	Power Glen to Hamilton	44,000	33	6
Winnipeg Municipal	Pte. du Bois to Winnipeg	66,000	78	20
Calgary Power Co.	Kananaskis to Calgary.	50,000	50	7½
West Kootenay Power & Light Co.	Bonnington to Greenwood	60,000	82	10
B. C. Electric Ry. Co.	Jordan plant to Victoria	60,000	43	16

With present high prices showing every indication of remaining at the present high level, transmission lines now under construction and planned will cost considerably more than lines built under pre-war conditions. The following costs are approximately those existing in Ontario at the present time.

A main line "heavy duty" steel tower transmission line, carrying two lines at 110,000 volts, such as the latest type of line used by the Hydro-Electric Power Commission of Ontario between Niagara Falls and Toronto, with 66-ft. right-of-way, the equivalent to four No. 4/0 copper conductors, telephone service, and all items of expense, would be about $17,000 per mile.

A 110,000-volt line, single circuit, supported by wood poles, with 66-ft. right-of-way, and the equivalent of No. 1/0 copper conductors, and telephone line, would be about $8500 per mile. The cost might be reduced to about $5500 per mile if pole rights alone are secured.

A 44,000-volt, wood-pole line, with steel conductor and telephone line on same poles, could be erected for about $3000 per mile. If there were considerable rock excavation for poles, however, this cost might be doubled.

A 22,000-volt line, carrying one circuit of approximately the equivalent of No. 1 copper conductor and with telephone line, would cost about $3500 per mile.

Smaller lines for about 4000 volts, with equivalent of No. 4 copper conductors, have been built for about $2000 per mile under present conditions.

REARRANGEMENT OF BAFFLES AND SETTINGS IMPROVES OPERATION.

Four Instead of Three Passes and Rear-End Firing Banish Smoke and Increase Capacity—Excerpts from Paper Before O. E. L. A.

By W. A. Aldrich,

Cleveland Electric Illuminating Co.

The Cleveland Electric Illuminating Co. operates 70 Stirling boilers at its Lake Shore Station, averaging about 600 hp. each. All are equipped with chain grates. Some extremely interesting experiments and changes have been made on this equipment.

The first big change on our Stirling boilers was made some years ago, when after months of testing we changed them all from the standard three-pass baffling to four-pass baffling. That is, instead of using two baffles with each bank of tubes acting as a pass, we use four baffles. The first one is located between the first and second tube of the front bank. The second baffle is located between the first and second tube of the second bank. The third baffle is at the rear of the second bank and the fourth baffle is between the second and third tube from the rear of the third bank.

This arrangement gives the gases a much longer line of travel through the boiler and helps to eliminate smoke. The hot gases do not have the same tendency to shoot directly for the baffle opening at the top of the first bank of tubes and we were enabled to do away with a short sprung arch behind the flat stoker arch. Last, but not least, repairs are confined almost entirely to the first row tubes of the front bank which are very accessible.

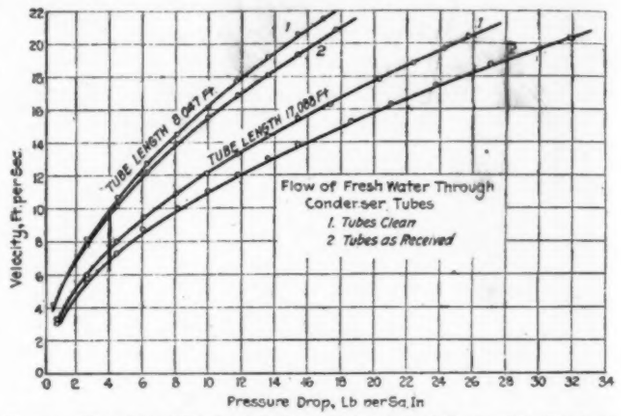
The next radical change in boiler settings was made a year ago when we installed sixteen 685-hp. Stirling boilers of the ordinary single type, four-drum boilers. These were raised up about 11 ft. higher than the standard setting, turned around, and fired from the rear end, namely, with the mud drum directly over the flat combustion arch which the company uses. The result is that the combustion space has been doubled, giving about 18 cu. ft. of combustion space per square foot grate area.

At no time since the boilers were installed has any black smoke issued from the stack which serves 16 of these boilers. The normal appearance of the stack shows a light gray haze which sometimes increases in quantity but never grows black. While as yet no very complete boiler tests have been made on this installation, it has been found feasible to operate at 12½% CO_2, and at 200% rating when desired, with all other combustion conditions satisfactory.

CLEAN CONDENSER TUBES AS AFFECTING FLOW OF WATER.

That condenser tubes become coated with a film of varying properties in course of time is known to every user of condensers. Sometimes this film is soft and slimy, sometimes hard and brittle and adheres to the surface of the tube with considerable tenacity. The rate at which these deposits are thrown down depends upon the water and foreign matter entrained and somewhat upon the velocity with which the water passes through the tubes.

Some recent experiments carried out at the U. S. Naval Engineering Experiment Station at Annapolis were described in a paper entitled "Flow of Water Through Condenser Tubes" which was presented at the December meeting in New York of the A. S. M. E. One fact brought out by the investigation, and a fact not perhaps usually appreciated by operating engineers, is that the amount of water—hence, the velocity—passing through new tubes for a given pressure may be affected considerably by the condition of the tubes as received from the manufacturer. The accompanying set of curves show the velocity of the water passing through two sets of ⅝-in. tubes, the one about 8 ft. and the other 17 ft. in length, as received from


Velocity, Ft. per Sec.
Pressure Drop, Lb. per Sq. In.
TUBE LENGTH 8 047 Ft.
TUBE LENGTH 17 088 Ft.
Flow of Fresh Water Through Condenser Tubes
1 Tubes Clean
2 Tubes as Received

Curves Showing Effect of Tubes as Received From the Factory and Cleaned Tubes Upon Flow of Water.

the manufacturer and after cleaning. The cleaning was done by passing a small rag soaked in kerosene through the tubes several times.

The tubes were standard ⅝-in. condenser tubes (as used for marine purposes), being of No. 18 gauge with an inside diameter of 0.522 in.

The accompanying curves are interesting because failure to clean the tubes of a new condenser preparatory to a test might give results that would be misleading and unfavorable to the manufacturer.

TWO STATION GROUNDS MAY BE SOURCE OF TROUBLE.

In substations containing apparatus for serving street railways and also a 4000-volt four-wire three-phase distribution system it appears advisable to employ the same ground for the railway negative or return that is used for the neutral or middle point of the 4000-volt system. Failure to do this, by employing two separate earths, namely, the water piping system for the railway system and an earth plate for the distribution system, may lead to trouble during times of short circuit, due to resistance drop resulting in piling up of voltage between the two station grounds.

EXTENSIVE GROUND TESTS CONDUCTED BY SOUTHERN CALIFORNIA EDISON CO.

Eleven different types of grounds have recently been made by the Southern California Edison Co. The purpose of these grounds is to enable extensive tests to be made to determine the relative efficiency of each type, its permanence during the different seasons of the year, unit cost, etc. With this data obtained, the tests are to be carried on over an extended period of time, the company will be able to know the type of ground best suited to different conditions, the constancy of the ohmic ground resistance, etc.

Contractor-Dealer

Method of Getting List of Prospects—Making Window Display Sell—Ten Commandments for Retailing Appliances

HOW TO GET A LIST OF PROSPECTS FOR VACUUM CLEANERS.

An Effective Method Used by Illinois Dealer to Obtain Names and Addresses of Prospective Customers.

It is often an easy matter to reach through their children people who do not respond readily to a direct appeal. The experience of an electrical dealer in Cairo, Ill., is a case in point. A manufacturing firm whose line of sweepers he handled had prepared an attractive little booklet entitled "The Story of a Lump o' Dirt." It was attractively illustrated and related the experiences of a lump of dirt—"just an ordinary lump o' dirt out of the road"—(to use its own designation as it writes its autobiography) in connection with a broom, a carpet sweeper and a vacuum cleaner. Here was a fairy story, with a deeper meaning, that would appeal to all.

This enterprising merchant secured a quantity of these books and then advertised in the papers: "A Modern Fairly Tale—free to all children between the ages of eight and sixteen." The advertisements went on to state that to all children who called on a certain Saturday afternoon one of these books would be given free. All that was necessary to secure a book was to sign a card containing the name and address of their parents. If any one doubted the efficacy of advertising he had only to stand near the store that day and watch the crowd of children that streamed through the door from one o'clock until closing time. Close to a thousand booklets were distributed and they found their way into homes in every section of the city. Best of all, they were read by hundreds of grownups who would never have taken the trouble to glance through the book if it had been handed or mailed to them direct. From the list of addresses mailing list was compiled, and about a week later a circular letter was mailed to the parents:

> Dear Sir (or Madam):
>
> We presume you read the little booklet brought home by your young son or daughter—and of course the story had a deeper meaning than it did to the children. Have you not often had experience in your own home with the lump of dirt that was tracked into the house and deposited on carpet or rug, becoming so imbedded that it resisted all your efforts to dislodge it?
>
> You read in this little story how the Blank suction cleaner did the work, and it ocurs to us that you might like to see this proven in your own home. Just ear off the slip at the bottom, sign your name and address, and we will be pleased to arrange for a free demonstration of the wonderful cleaning powers of this electric suction cleaner.

At the bottom was a perforated slip, requesting a free demonstration of the merits of the Blank cleaner, with space left for name and address. The demonstrations took place at the earliest date practicable, and at its conclusion full information as to the cost of the cleaner and the remarkably easy terms on which it was sold was left with the mistress of the house. The firm's efforts did not end here, as later a personal call by one of the salesmen was made, while literature on the subject was sent at regular intervals until a sale was made or intimation given that the householder was no longer interested—something that very rarely happened.

USING THE WINDOW DISPLAY TO SELL AS WELL AS SHOW.

Here's a suggestion from an electrical jobber—the Doubleday-Hill Electric Co., Pittsburgh. It's about window displays.

Every one knows that electrical devices lend themselves readily to display, not only because most of them are well appearing but because of the natural

Window Display Arranged with the Idea of Creating Sales.

curiosity that attaches to all things electrical. According to the Doubleday-Hill company, the electrical dealer can't afford to depend upon those appeals alone in planning his window displays. Instead of just "showing" some appliances, the dealer has to give some message or idea in connection with his display in order to get the window shopper's attention and interest. A few appliances in the window display space won't do. There must be something more.

To interest householders in vacuum cleaners the company recently had a display in which a vacuum cleaner was taken to pieces and the component parts were neatly arranged against a green velvet background, the idea being to show the simplicity of construction of the machine in question. Cards were used to invite those interested to go into the store to see just how the cleaner worked.

There wasn't much more to this display than one in which a few machines were just "shown," but there was enough idea and suggestion to give it good sales value. And it brings out the point that electrical goods must not only be displayed, but some distinct effort be made in the display toward selling them.

The Ten Commandments for Selling Electrical Appliances

Pertinent Rules That the Salesman Should Know and Use in Dealing with Customers in an Electrical Store

THOSE with limited experience in selling electrical appliances will find here time-tried and tested methods worthy of being followed. Older and more experienced heads may perhaps find refreshment of memory concerning some methods they learned long ago and have been neglecting to use.

For convenience in presenting and, also, making use of these helps, they are being given in the form of "The Ten Commandments of Appliance Selling."

1. *Know your appliances—what they will do and how they do it.*

When explaining the electric grill, don't stop with saying "this compartment is for broiling, this section is for frying and that one for stewing." That's too indefinite. It does not properly lead the customer to think of the service of the appliance. It's the need for the service of the appliance that has aroused the prospect's desire to possess it, rather than any interest in its constructional features.

When discussing the broiling section of the grill, for illustration, state in definite terms that it will broil steaks, chops, ham, fish, oysters, pressed meats and, if desired, vegetables such as egg plant and parsnips. That is to say, the way to bring the prospect to think of and desire the service of the appliance is to explain in detail the scope and advantages of that service. Failing to do that, you cannot hope to effect a sale.

Be able also to give, and make a point of giving, reasonably accurate figures as to the cost in cents per hour for each and every service and operation performed by the appliance you are selling. Put stress also upon the saving in time made possible by "doing it electrically." Above all else, be able to demonstrate —not merely tell—just how the appliance should be operated to insure the best results.

2. *Know your customer.*

Old hands at the selling business classify all prospective customers as either "lookers" or "listeners." By the first term they mean those who trust entirely to their own judgment and buy only those things which pass their close and critical scrutiny. They are the ones who must be shown, who demand that every little phase and feature of the thing to be bought be submitted to examination of hand and eye. They place little or no confidence in the words of the salesmen—they insist upon being shown.

The second class much prefer to be guided by the suggestions and statements of the salesmen and they will do so always, provided he can inspire them with confidence. They will listen attentively to what is told them and they will get the general sense of it all. But their first concern is to decide if they may safely trust to the judgment and sincerity of the salesman. They don't particularly desire to be shown—they want to be told, as it is only by getting the salesman to talk and analyzing his statements that they can decide whether he knows his business and is to be trusted. Once they have decided that point in his favor, they then will revert to this, that or the other feature of the appliance as explained by the salesman up to that time and desire further enlightenment or instruction regarding points they appeared to understand in the first instance but did not, because at that time they were more concerned in judging the salesman than in deciding the merits of the appliance.

Your own intelligent study of your customers will be your best guide in classifying them properly. The listeners desire to be told, and the lookers must be shown. If you are not conducting your selling talk in harmony with their preferences you will, if you are acutely alive to your opportunities, recognize your mistake very quickly and can then change over.

3. *Aim to discover and cater to the prime desire that prompts the customer to buy an appliance.*

The need behind the need, so to speak, is the one that should be catered to in effecting a sale. Man has certain basic instincts. They constitute the source of all desire. All actions, efforts and thinking is to the end of satisfying or appeasing desires occasioned by the persistent or momentary urge of one or the other of those basic instincts. If the prospect's desire is strong enough, and his belief in the thing offered for sale is well grounded, the matter of closing the sale simmers down to the operation of inciting the prospect to satisfy that desire by the action of buying and possessing that thing.

An illustration will make that principle plain: Mrs. A., for instance, is a woman in whom the desire for comfort and ease is paramount. She abominates having to arise and prepare breakfast for her husband, who departs for business at a very early hour. Her object is: "How to provide breakfast for her husband without having to sacrifice her own love of ease." An invalid friend explains how her husband prepares his own breakfast by the aid of electrical table appliances. Mrs. A. immediately develops a desire for electrical table appliances and calls upon you that she may learn more about them.

Eventually, of course, she will come to appreciate their fuel, food, time and labor-saving qualities. But for the moment her chief interest is in how they will enable her husband to prepare his own simple breakfast of eggs, toast and coffee. The arguments regarding the appliances that will work best in this instance are those relating to the ease, simplicity and reliability of their use and operation. Those are the factors that cater to her desire for ease and luxury, by enabling her to lie comfortable abed while her husband prepares his own breakfast.

Aim to discover the controlling desire which prompts the need for the appliance. There is such a basic desire in every instance. A little study of your prospect will enable you to discover it. Then conduct your selling talk accordingly.

4. *Keep away from talking watts, amperes, voltage, and so on.*

Every item brought into a sales talk about appliances which the prospect does not understand adds just one thing more, one doubtful point, which must be explained before the sale can be consummated. Such terms as watts, amperes and voltage are not understood by the average woman; and women buy most of the appliances.

Confine your talk to plain, everyday terms that all will understand. If you must employ technical terms make a point always of explaining them.

5. *Don't refer to electrical appliances as "current-consuming" devices.*

That electrical table appliances consume current is true. Nevertheless that is merely incidental to the service their use affords. They should be referred to in terms suggesting their services. They are fuel, food, time, labor and money-saving devices. Refer to them accordingly.

6. *Always refer to operating cost of appliances in terms of cents per hour.*

To refer to operating cost in terms of current is confusing to all but the technically informed. Besides, it's a lazy man's way of conveying the facts. Because when the operating cost is given in terms of current the prospect then is compelled to translate the statement into terms of cents per hour to operate.

If the translation is not made the statement only serves to confuse. It fails to further the customer's understanding. Attention which should be devoted to following the salesman's talk is distracted by the effort to understand the technical phraseology.

7. *Show appliances in actual operation.*

The power of demonstration is too well recognized to require emphasis. Telling the customer that a toaster, say, will within two minutes generate ample heat for toasting is a poor substitute for allowing the customer to place a hand near the appliance and discover by actual experience the heat radiating therefrom.

8. *Don't invite consideration of too many appliances.*

Attention must be concentrated upon one appliance before a purchase is made. The greater the number of appliances suggested the greater the number which must be eliminated from consideration before attention can be centered upon the one particular appliance it is held in mind to buy.

Decide as quickly as may be possible in your own mind which appliance will best suit the needs of the customer. Then concentrate your efforts upon selling that appliance. Make every reasonable effort to sell it before suggesting another one. That method becomes particularly desirable when you are dealing with a "listener."

9. *Aim always to display the best make of appliances first.*

In selling it is always easier to come down in the scale of quality and price than to start at the bottom and work up to the most costly. Also, a customer is always secretly flattered by being shown the most expensive article of a class first, even though it is in mind to purchase something less costly.

Frequently, too, such tactics lead to the sale of a better article than otherwise would have been so. First impressions are apt to be lasting. So aim to have that first impression truly representative of the best in quality and service possible with the class of appliances in question.

10. *Attach to appliances tags showing price and cost in cents per hour to operate.*

Many who visit your store have used electrical appliances and are thoroughly sold on their manifold advantages. Frequently they come in with minds

made up to purchase a certain type of appliance and require only to be told the price. In such instances the tag makes the sale while you perhaps are busy with other customers.

There are many occasions in even the best equipped and regulated stores when customers cannot be given attention immediately they have entered. At such times, the tags will prove helpful in occupying the customer's attention.

Best of all is the service the tags perform in connection with a very generally observed human characteristics. Many folks incline to place more confidence in what they read than they do in what is told them, and the tags support the salesman's statement regarding the operating cost of the appliances.

TIMELINESS IS FEATURE OF NOVEL SALES PLAN.

California Dealers Build Up Sales Campaign Around Fact of Shortage of Sugar.

A note of timeliness is just as desirable in advertisements and selling plans as it is in window displays. Taking advantage of the recent (?) shortage of sugar, Alfred Stahel & Sons, San Diego, Cal., offered a prize each week for a period of six weeks for the best menu in which sugar substitutes were used.

Each week they advertised a different electric utensil—percolator, toaster, waffle iron, grill, etc., and alongside of it the winning menu of the previous week—coupling the two by showing how much easier it was to prepare food by the electric method. Their advertisements received wide publicity, since they were scanned by all the competitors and their friends, to see if their own particular menu had been published, while the way in which they linked the menus with electric cooking utensils brought them to the attention of scores who had never before given much thought to the wonderful efficiency of these devices.

The window display each week featured the particular electric convenience which was being advertised in the papers, and set in racks were printed cards containing some of the best menus submitted, together with the names of the originators. You may be sure that these windows received careful scanning from hundreds of feminine eyes, and as there were cards, lettered in bright colors, stating the name, use and price of the electrical merchandise shown, it was brought prominently to the attention of everybody who saw the display.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 475.—Pricing Motor Repair Work.—Can some of the readers through the questions and answers columns give me the best methods of pricing repair work on electric motors, armature winding, etc., and the best methods of setting the selling price of insulating materials and of magnet wire?—D. D., Indianapolis, Ind.

No. 477.—Floor Outlets in Living Rooms.—I should like to have the statements of readers as to their practice in wiring large living rooms in residences where several floor and table lamps are likely to be used and no ceiling fixtures are specified. In a particular case of this sort the architect called for six bracket fixtures and no wall or floor receptacles. I pointed out to him that on account of the size of the room (18 ft. by 22 ft. 6 ins.) any table or floor lamps would require long cords to reach the brackets unless these lamps were used quite close to the wall, in which case the lighting of the center of the room would be poor. Such long cords and few outlets would cause trouble. Therefore I recommended adding at least two floor receptacles and four baseboard receptacles. The architect objected to floor outlets as too likely to cause trouble. Was my recommendation in accord with the best practice in such cases? Has any serious objection been found to floor outlets?—J. O. B., Pittsburgh, Pa.

No. 478.—Lamp Bank for Testing.—In several repair shops I recently noticed use of a lamp bank arrangement with 0-300 ammeters for testing armatures for "opens," "shorts," etc. I would like to get through the queries column a wiring diagram for such a lamp bank arrangement that is not too complicated to make in the shop. I have tried several schemes without good results.—J. D., Detroit, Mich.

No. 479.—Boiler-Furnace Explosions.—I would like to know if anyone has had similar experiences to mine. We find since burning bituminous run-of-mine, that the fire door is often blown open with considerable force. At other times when the fire door is opened an explosion occurs and flame and coal is ejected into the boiler room. Just what are the causes of this, and how may they be overcome without changing the grade of coal?—J. R. K., Belvidere, Ill.

No. 480.—Depreciation Reserve of Utilities.—What is the present prevailing practice on the part of public service commissions as to how the depreciation reserve of public utilities shall be kept? Is this fund always kept separate and distinct from other sinking funds or reserves? Do the commissions approve lumping it in with the general reserve of the utility?—A. E. M., Little Rock, Ark.

Answers.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

So far as the writer is able to ascertain, actual operating costs of small electrically operated refrigerators, such as are employed in small stores, residences, etc., are not available. The manufacturers of such outfits are able to give operating costs as estimated by them, but these do not cover all the actual costs, which embrace maintenance charges, interest on investment, etc.

The cost of operation depends, of course, upon the size of the refrigerator and the conditions of its use, that is the amount of ice it produces or the degree of refrigeration accomplished, the climate, the temperature maintained and the frequency with which the refrigerator is opened and closed to permit removal and replacement of the product cooled.

Of the actual operating costs, neglecting the interest upon the investment, the cost of electric power is the chief. There is also a maintenance charge, but this is usually extremely small, and is due to the periodic cleaning of the motor, cooling coils, lubrication, etc. The conditions under which the refrigerators are usually installed are such that the owner pays little attention to his cooling apparatus once it is in service. The monthly electric bill is rendered and paid, the water meter is read, the bill is rendered and paid, and so on.

The better of these refrigerating outfits appear to be reliable and to give little trouble. Where the annual consumption of ice or the amount of refrigeration is sufficient, money invested in a self-refrigerating outfit is a sound investment. But for such to be the case the total operating costs plus the interest on the investment must be less than the cost of purchasing ice. This condition practically precludes the use of small domestic refrigerating plants except by the large user of ice.—M. S. O., Detroit, Mich.

No. 476.—Colored Lighting Effects in Theater.—In producing the various changeable colored lighting effects in a theater that are now becoming so popular what is the smallest number of primary colors that will serve? Is it possible to get more pleasing gradations of color through using more sets of differently colored lamps than of primary colors alone? What is the most practical way to secure such color effects?—H. M. P., Seattle, Wash.

The best results for the polychrome lighting of theater auditoriums, etc., are most effectively produced by the use of type "C" Mazda lamps in silvered mirror glass reflectors of the proper capacities and design set in suitably ventilated holders with provision for glass or gelatine color screens or mediums. To get the most effective distribution of colored illumination it is absolutely necessary to use the best reflectors obtainable; also avoid color screens which contain opaque colored particles from which the colored light is produced by reflection. The three primary colors: red, violet and green constitute the smallest number that will serve to obtain the most pleasing effects. It is possible to get the greatest number of shades and gradations by the use of the graphite compression type dimmers, which give a greater number of variations and stand up better than the commutator contact type for this purpose. If the dimmers are driven by means of motors, the various colors can be blended into each other much more gradually than if same are worked manually. Although white lighting can be produced by the proper mixture of the three primary colors, it is the usual practice in laying out polychrome lighting installations to include white lighting in addition for efficient general illumination and for use also in fading the various colors.—A. R. L., Chicago, Ill.

SKIP-STOP MAKES PLEASING SAVING IN NEW HAVEN, CONN.

Among the traction companies adopting the skip-stop during the acute fuel shortage that occurred during the winter of 1917-1918 was the New Haven Traction Co., which serves New Haven, Conn., and adjacent territory with transportation. It is reported that the skip-stop has resulted in an annual saving of about $8000 and that both the public and the utility favor retaining the skip-stop.

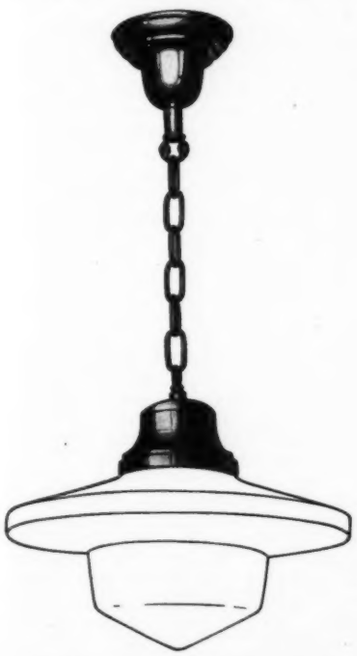
New Appliances

Commercial Fixtures Especially Designed for Glass Units—Cigarette-Making Machine Employing Electric Heater

Brass Fixtures Specially Designed for Glass Commercial Lighting Units.

A series of commercial fixtures for use with the Ivanhoe "Ace," Phoenix and other recently designed glass units employed in connection with high-powered lamps, is announced by the F. W. Wakefield Brass Co., of Vermilion, Ohio. These units bear the Wakefield "Red Spot" mark, which identifies and guarantees all goods of this company's manufacture.

These Wakefield commercial fixtures are made wholly of brass and, as regularly shipped, include porcelain receptacles of special patented design built into the holders. They are entirely dustproof and cannot serve as the graveyard for flocks of bugs.



Wakefield Brass Fixture Specially Designed for the Ivanhoe-Regent "Ace" Glass Unit.

Wakefield Commercial Fixture for Glass Inclosed Unit.

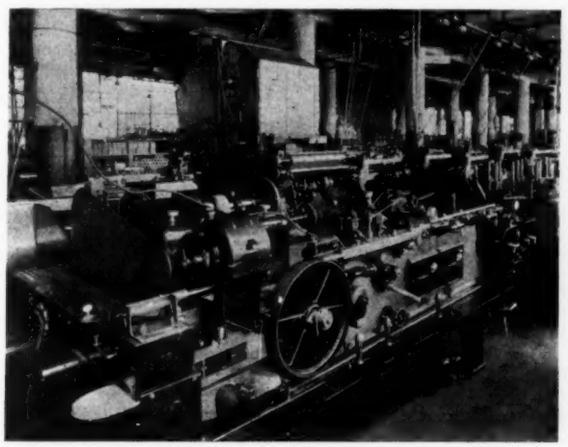
Being packed one unit to the carton and plainly labeled, these fixtures are particularly convenient for the jobber and dealer to handle. The package need not be opened until the fixtures are on the job, thus there can be no possible loss of parts, injury to finish or deterioration in stock.

The designs of these Wakefield commercial units, as indicated by the illustrations, are such as to appeal to contractors and fixture dealers supplying equipment to the better class of stores, offices and public buildings.

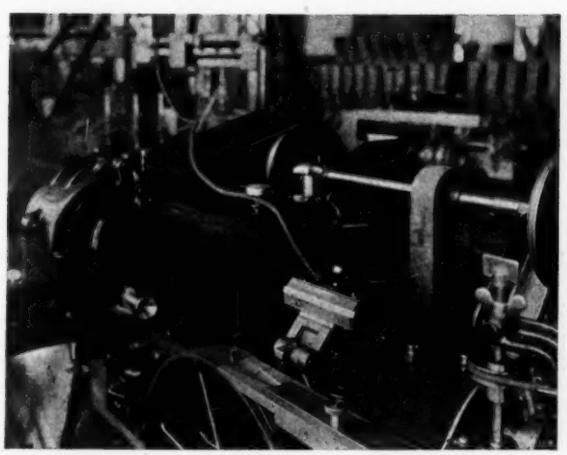
Electric Heater Used in Cigarette Manufacture.

An interesting and novel use of electric heating is found in a cigarette-making machine manufactured by the American Machine & Foundry Co., Brooklyn, N. Y.

Cigarettes, being now produced by the million, are of course made by automatic machines which perform the entire process. At one end of the machine is a roll of cigarette paper, and a hopper containing the tobacco. The paper goes through the machine in a long continuous strip. It first passes through a series of rolls, which print on it at the proper intervals the maker's name, etc., and then it is carried over a concave plate, several feet long, where it receives the tobacco. Then the paper strip with its load of tobacco passes under a grooved wheel which molds the tobacco into the proper shape, and next the edges of the paper are folded over. The remaining steps of the process are the application of paste to the edge of the paper, the drying of the paste by the electric heater, the cutting of the long cylinder into cigarette lengths by a circular saw, and finally the stacking of the cigarettes in the hopper at the end of the machine.



General View of Cigarette-Making Machine.



Near View of the Electric Heater Swung Up for Inspection.

The electric heater is of an oblong shape with a long, narrow ironing surface which rests on the traveling cigarette tube and quickly drives out the moisture in the paste. It consumes about 100 watts and is of Westinghouse make. A similar heater is also used for drying the paste of labels and stamps on boxes and cans.

Trade Activities

Fairbanks-Morse To Erect Large Modern Foundry at Beloit —F. H. M. Riley Appointed Manufacturers' Representative

Edison Electric Appliance Co., 5660 West Taylor street, Chicago, is sending out announcements of an advertising campaign on Hotpoint electrical devices to be conducted in various national publications. In this connection the company is introducing the Hotpoint gift certificate idea, which consists of neatly printed certificates which may be used by dealers, who may have depleted stocks of electrical devices, to enable customers to make electrical gifts, even though deliveries cannot be made before Christmas.

Francis H. M. Riley, formerly associated with Vaughn & Meyer, Milwaukee, consulting engineers, announces his appointment as Wisconsin representative, with offices at 514-615 Security Building, Milwaukee, for the following companies: Vulcan Soot Cleaner Co., Du Bois, Pa., designer and manufacturer of Vulcan mechanical soot cleaners for all types of boilers and economizers; Vulcan Fuel Economy Co., Chicago, manufacturer of Vulcan Lastite, Vulcan-Orsat gas analyzers, Vulcan gas collectors, boiler tube cleaners, differential draft gages and smoke indicators; Green Engineering Co., East Chicago, Ind., designer and manufacturer of Green chain-grate stokers, jet ash conveyors, pressure waterbacks, Sel-flex ventilated arches and materials, transfer and storage hoppers. Mr. Riley and the organizations which he represents will render especial service and assistance to all who are interested in the effective solution of the problems of reduced fuel, power plant operation and production costs.

Benjamin Electric Manufacturing Co., Chicago, Ill., has published a book on industrial lighting that embodies much practical information for applying the principles laid down by illuminating engineers as the best practice in the lighting of buildings and areas devoted to industrial uses. The book has been prepared with a view of being helpful to anyone whose objective is the attainment of correct industrial lighting. It is a response to the demand for genuine service to all departments of industry seeking to raise standards of production, reduce accidents and spoilage and to make the task of the worker more acceptable through the application of higher lighting intensities. The considerations governing the selection of lamps and reflectors are explained in simple terms. There is a chapter on general illuminating information, with tables and definitions which reduce to simple terms the complex formula out of which correct deductions with regard to the specification of lamps and fixtures are solved. There is a table giving the foot-candle intensities desirable as worked out from a consensus of the best opinions of illuminating engineers and physicists, and a complete presentation of the electrical symbols used on architects' drawings. The catalog data relating to Benjamin industrial lighting equipment is arranged in orderly sequence, carefully indexed, and gives the reader a comprehensive idea of the material available to meet the wide range of industrial lighting requirements. A feature of unusual interest is the charts of industrial fixtures which present a study of reflector contour, light distribution diagram and lamp size so that the specification for any particular use is easily arrived at without recourse to any data other than those given in the book. Numerous examples of industrial lighting requirements, with actual photographic reproductions of results, add greatly to the usefulness of this very practical book on industrial lighting.

Fairbanks, Morse & Co., Chicago, will start next year the erection of a new plant in Beloit, Wis., which it claims will be the largest and most modern foundry in the world and will involve an expenditure of approximately $1,500,000. Many months of study have been given to this enterprise, with the result that every protection for the safety and health of the employes, every modern, scientific foundry device, improvement in the casting of gray iron, will be incorporated in the new plant. Electric cranes will carry the raw materials to and from the big cupolas. Electric grab buckets will unload the molding and core sand and coke; electromagnets will grip the raw pig iron and remove it from the cars; and electric cranes and conveyors will carry all molten metal from the cupolas to every mold, whether for giant castings of 10,000 lbs. or a few ounces. The structure will, when completed, be 900x550 ft. and will contain 495,000 sq. ft. of floor space. This building, including storage of flasks, iron, sand, etc., which will also be under the roof, will cover 11 acres of ground, and will be located directly to the north of the present house, bordering the River road. The completed structure will have an ultimate capacity of 350 to 400 tons of gray iron daily. The foundry will eventually employ 1,500 additional men; and 1,500 more men will be required in other departments of the factory to meet the increased production that will result. Although the comfort of the employe has been intensively emphasized in the construction plans, mechanical efficiency has received due consideration, provision having been made for a giant electric crane system which will distribute all materials to every part of the plant. The new foundry will allow the company not only to handle the iron now used with greater efficiency, but will increase the output greatly. Excavation work will be started as soon as weather conditions permit in the spring and construction work will be pushed rapidly.

Altorfer Company to Double Manufacturing Facilities.—The remarkable growth of the electric washing machine industry and the constantly increasing demand for this labor-saving device, is exemplified in the announcement of the Altorfer Brothers Co., Peoria, Ill., manufacturer of the "Super-electric" washing machine. Notwithstanding the fact that the company moved into a large new factory last June, it again finds its facilities wholly inadequate to meet the demand for its product and is, therefore, erecting another new structure which will increase its present output by 50%. The building will be 100x600 ft., and will provide total floor space of 200,000 sq. ft. This will be the second factory erected this year, the new building being of the same size as that occupied June 1 last. The Altorfer company, which was one of the first to enter the washing machine field, is now one of the largest producers, and the "Super-electric" washing machine which it has developed is considered one of the most efficient and most popular on the market.

Leeds & Northrup Co., 4901 Stanton avenue, Philadelphia, Pa., manufacturer of electrical measuring instruments, is distributing catalog No. 86-B which has for its title "The Optical Pyrometer," a portable instrument for works temperature measurements. This book, containing 28 pages, describes the instrument and its practical applications in gaging temperatures in the open, fuel beds, heat treating furnaces, muffle furnaces, in the rolling and forging of steel, blast furnaces, electric furnaces, of molten steel and slag, molten cast iron, molten non-ferrous metals, molten glass, ceramic furnaces, etc., for checking thermocouple pyrometers. This optical pyrometer, employing a balance method of comparising luminous radiations, measures temperatures from a dull red (1,200°F.) up to the highest known temperatures, and makes use of the most accurate method based on radiation so far developed for measuring temperatures. The bulletin is well illustrated and contains considerable data on temperature measurement with optical pyrometers.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

North Stratford, N. H. — Warner Sugar Refinery Co., 79 Wall street, New York, has awarded a contract to C. A. Ridlon, Roulette, Pa., for the erection of a 1-story power plant and barrel works, about 75x80 ft. and 64x120 ft., respectively, at North Stratford.

Rutland, Vt. — Stasa Milling Co., Castleton, Vt., is negotiating with the Rutland Railway, Light & Power Co. for the furnishing of additional power for the operation of its plant. The company will require a total of about 1500 hp.

Watertown, Mass. — Oakville Co. has recently inaugurated work on the construction of a new 1-story generator house at its plant in the Oakville district. The structure will be about 44x56 ft. The Fred T. Ley Co., Main street, Springfield, Mass., is the contractor.

Pawtucket, R. I. — In connection with the construction of the new 2 and 4-story plant of the Tubular Woven Fabric Co., to cost approximately $200,000, considerable electrical equipment for operation will be required. O. D. Purington & Co., Industrial Trust building, Providence, are the contractors.

Amenia (Dutchess County), N. Y. —Application has been filed with the Public Service Commission by the Amenia Electrical Light & Power Co., for permission to construct and operate a local electric light and power plant. The company has been granted a franchise by the municipality.

Binghamton, N. Y. — Binghamton Light, Heat & Power Co. is completing the installation of a 2500-kw. turbine unit at its plant. The company has completed the construction of a new 5-mile transmission line to the plant of the Endicott Johnson Corp., Endicott, N. Y.

Buffalo, N. Y. — City council is understood to be considering plans for the construction of a new municipal electric light and power plant.

Churchville, N. Y.—The city contemplates the installation of a new electric lighting and power systems. Bonds in the sum of $25,000 have been voted for the construction.

Hamden, N. Y.—Hamden Electric Light Co. (Delaware county), has filed application with the Public Service Commission for permission to construct and operate an electric light and power plant for local service.

New York, N. Y.—Ophuls, Hill & McCreary, Inc., 112 West 42nd street, engineer, is completing plans for the French Government, Artillery Department, Commissariat General Des Affairs de Guerre, France Americanes, 65 Broadway, New York, for the construction of a large new electric lighting plant to be located on the Isle of St. Pieppe, off the Coast of New Foundland.

Portville, N. Y. — Portville-Cattaraugus County Utilities Co., Inc., has recently filed application with the Public Service Commission for the necessary permission to erect and operate a local electric lighting plant for furnishing service to the municipality from which a franchise has been secured. The company also requests approval of the issuance of capital stock for $50,000, the proceeds to be used to cover the cost of the proposed work.

Rochester, N. Y.—Josiah Anstice Co., 220 North Water street, has had plans prepared for the construction of a new 1-story power plant and boiler house, to be located on Humboldt street, between Culver road and Coventry avenue. The structure will be of brick and steel, about 50x100 ft. G. Morton Wolfe, 1377 Main street, Buffalo, is architect for the company.

Butler, N. J.—Borough council has authorized the lighting committee to prepare plans and specifications for the installation of a new electrically operated pumping unit for the municipal plant.

Dover, N. J.—In connection with the proposed opening of a new mine in the vicinity of Dover, the Prior Chemical Co. will utilize electric power comprising a total of about 150 hp. in motors.

Dover, N. J.—Dover Boiler Works has recently completed the installation of a quantity of new equipment at its plant, including new air compressor unit operated by a 264-hp. capacity synchronous motor, new pumping unit direct connected to a 150-hp. motor, and other apparatus. Power for operation is furnished by the New Jersey Power & Light Co.

East Orange, N. J. — Plans are under consideration by the city council for the installation of a new municipal electric lighting plant, as well as a new electric street-lighting system.

Jersey City, N. J.—Plans are under consideration by the city officials for the establishment of a new "white way" street-lighting system in lower Broadway. The Downtown Business Men's Association is interested in the proposed work. Service is furnished by the Public Service Electric Co.

Midvale, N. J.—Tri-County Electric Co., Pompton Lakes, is making rapid progress on the installation of a new electric street lighting system.

Newark, N. J.—General Laundries have had plans prepared for the construction of a new brick and reinforced concrete plant to be located at 93-97 Summer avenue and 33-41 High street, to cost about $72,000. Considerable electrical equipment will be required.

Newark, N. J. — Hochbaum-Rylander Electric Co. has filed notice of organization to operate at 539 Central avenue, for the production of electric and gas fixtures, etc. Frederick Hochbaum and Ernest J. Rylander, 15 Montrose street, South Orange, head the company.

Orange, N. J. — Central Storage Battery & Radiator Co. has filed notice of organization to operate at 353 Central avenue, Orange. The company will specialize in the repair of storage batteries. H. S. Johnson, Sr. and Jr., both of Glenwood avenle, Orange, head the company.

Beaver Falls, Pa.—Electric Service Co., Inc., operating a local plant for the repair of storage batteries, armature winding, electric welding, etc., has completed the removal of its works to its new plant at 700 3rd avenue, Pittsburgh. The new plant is a 3-story, and considerable new equipment and machinery has been installed to allow for increased operations.

Erie, Pa.—Plans are under consideration by the General Electric Co. for extensive additions to its local plant. It is understood that the plans include the erection of a large new machine shop, which will be the largest department at the local works.

Essington, Pa. — Westinghouse Electric & Manufacturing Co. is having plans prepared for the construction of a new 2-story steel and concrete addition to its local plant, about 130x500 ft., to cost, including equipment installation, close to $1,000,000. The company has completed negotiations for the sale of its land holdings on Duquesne Way, extending through to Fayette street, Pittsburgh, 66x328 ft., with 1-story steel factory building, for a consideration of about $175,000.

Philadelphia, Pa. — Considerable new electrical equipment will be required in connection with the construction of the proposed new newspaper publication plant of the Philadelphia Public Ledger Co., to be located at 6th, 7th, Chestnut and Ransom streets. The building will be a 10-story brick, about 230x385 ft., and will cost about $5,000,000.

Reading, Pa. — Reading Transit & Light Co. has recently completed work on extensive improvements in its traction system in Reading, Norristown and Lebanon.

Youngsville, Pa. — The city will

soon have its streets lighted by electricity through the public spirited action of a number of its business men. Power will be secured from the surplus power of the water plant. The new equipment will be purchased by business men.

Norfolk, Va.—Virginia Railway & Power Co. is understood to be arranging plans for its expansion program for 1920. The work will include extensive improvements to street-car and lighting facilities, plant improvements, the purchase of new rolling stock, and other work, and will cost in excess of $1,000,000.

Janelow, W. Va.—Plans are under consideration by Burton M. Davisson for the installation of new electric light and water systems.

Weyer's Cave, W. Va. — Weyer's Cave Light & Power Co. has filed notice with the Secretary of State of an increase in its capitalization to $100,000, to provide for general business expansion.

Chimney Rock, N. C. — Southern Bell Telephone & Telegraph Co. will construct a line from Asheville to Chimney Rock.

Lexington, N. C.—Lexington Telephone Co. will erect a 2-story brick building and install an automatic telephone system.

Rocky Mount, N. C.—Home Telephone & Telegraph Co. will install underground conduit system, and add additional section of switchboard. About $70,000 will be expended in improving the plant.

Denmark, S. C. — American Telephone & Telegraph Co. will erect a 3-story brick and stone building. Estimated cost from $75,000 to $100,000.

Due West, S. C. — City will construct a light plant. The sum of $16,000 in bonds has been voted. R. B. McDill, clerk.

North, S. C.—North Electric Light & Power Co. has advertised for one 50 or 75-hp. 3-phase generator, alternating current, also 1, 2 or 3 kw. exciter and switchboard complete.

Simpsonville, S. C.—Bonds to the amount of $15,000 have been voted for installing an electric light system. Address Mayor.

Summerville, S. C.—Commissioners of Public Works have approved the issuance of bonds for $40,000, the proceeds to be used for the installation of a new municipal electric light plant.

NORTH CENTRAL STATES.

Dayton, O.—About $200,000 will be expended for telephone exchange. Architect W. S. Hays, 212 Washington street, Chicago, Ill., has prepared plans. Owner, Union Central Telephone Co.

Hamilton, O. — An ordinance has passed the council providing for an issue of $50,000 in bonds to improve the municipal light plant. Address Mayor Smith.

Springfield, O. — Springfield Light, Heat & Power Co. is preparing to add equipment which will double its present capacity.

DATES AHEAD.

American Society of Civil Engineers. Annual meeting, New York City, Jan. 21-22, 1920. Secretary, Charles W. Hunt, 33 West 39th street, New York City.

Western Association of Electrical Inspectors. Annual convention, St. Louis, Mo., Jan. 27-29, 1920. Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

Oklahoma Utilities Association. Annual convention, Oklahoma City, Feb. 10-13, 1920. Secretary, H. A Lane, 611 State National Bank building, Oklahoma City.

Central Electric Railway Association. Annual meeting, Louisville, Feb. 26-27. Secretary, A. L. Neereamer, Indianapolis, Ind.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S A. Sewall, 29 West 39th street, New York City.

Northern White Cedar Association. Midsummer meeting, Lake of the Woods, Minn., June 12-17, 1920. Secretary, Norman E. Boucher, 702-3 Lumber Exchange, Minneapolis.

National Asociation of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6, 1920. Secretary, W. H. Morton, 110 West 40th street, New York City.

Ycungstown, O.—About $80,000 will be expended for telephone exchange. Architect W. H. Hays, assistant engineer, 2122 W. Washington street, Chicago, has prepared plans. Owner, Central Union Telephone Co.

Ashley, Mich.—The Ashley Community Association has been formed with a capital of $20,000. Electric lights are assured the village and work on the power house and plant will be started at once. Harry O. Rose, chairman.

Detroit, Mich.—Mutual Electric & Machine Co., 232 W. Fort street, will extend and remodel its 3-story plant and will cost about $12,000.

Decatur, Ind.—The contract for the General Electric Co. factory building in this city has been awarded to the Ferguson Construction Co., of Cleveland, O. The building will be 260x360 ft. The company plans to have its Decatur branch operating by March 1. It is said that the General Electric Co. will erect another building of the same size when the first one is completed.

East Chicago, Ind. — Edwards Valve & Manufacturing Co., which had extensive war munitions contracts, has converted its shop into an electric washing machine factory.

Evansville, Ind.—Schroeder Headlight & Generator Co. has changed its name to Sunbeam Electric Manufacturing Co.

Hagerstown, Ind.—Charles Brassman, 1503 Merchants Bank building, Indianapolis, will prepare estimates for a municipal light plant.

Indianapolis, Ind.—L. H. Van Briggle Chemical Co. will erect a new factory building which will adjoin the building of the Van Briggle Motor Device Co., both of which are controlled by the same interests. It is to be of reinforced concrete construction, of the same type of architecture of the motor device plant, and will house the factory and storeroom of the chemical company.

Indianapolis, Ind. — Pittsburgh Plate Glass Co. is having plans prepared for a new power plant.

Seymour, Ind. — A high-tension line, which is being built by the Interstate Public Service Co., between its hydraulic station at Williams, Ind. and this city, will soon be completed. The system is connected at Seymour with a high-tension line between Indianapolis and Seymour, also owned by the Interstate company. When the line is in operation the Williams' station will supply a large part of the electrical energy for light and power in Greenwood, Franklin, Edinburg, Columbus and Seymour, as well as many other towns.

South Bend, Ind. — Studebaker Corp. has announced plans for the erection of 1000 homes, made necessary by the opening of its new $15,000,000 automobile plant. A subsidiary home building company has been formed with a capitalization of $1,000,000 to carry on the building project.

Chicago, Ill.—Plans are being made for the erection of the Allerton Hotel, 16 stories, 600 rooms, 150x107 ft., to cost $1,500,000.

Chicago, Ill. — American Bond & Mortgage Co. has purchased the Unity building and will expend $450,000 in alterations. Indirect lighting fixtures will be installed throughout the 16-story building and the entire heating and power plants will be rebuilt and modernized. Between $75,000 and $90,000 will be expended in alterations of the bank floor, which will be occupied by new owners.

Chicago, Ill.—Mutual Tailoring Co. will build a 7-story plant, 100x120 ft., containing 84,000 sq. ft. of floor space and costing $400,000.

Grayville, Ill.—The city council will hold a special election for issuing bonds for the purchase of additional equipment at the electric power plant. It is expected the bond issue will carry, enabling the city to buy sufficient equipment for the light plant to guarantee continuous power service for a button factory which is under contract with the chamber of commerce to locate here.

Valdalia, Ill.—The question of issuing municipal light bonds will be submitted to vote. Address village clerk.

Benson, Minn.—City contemplates electric light plant improvements. Engineer W. E. Skinner, 15 South 5th street, Minneapolis, and Theo. B. Lee, superintendent, are preparing plans. Estimated cost, $40,000. I. M. Peterson, city clerk.

Duluth, Minn. — Western State Bank will erect $30,000 1-story bank building next spring.

Duluth, Minn. — Duluth Edison

Electrical Co. will install lighting system on Superior street, from 3rd Avenue East to 7th Avenue West. Eight 600-cp. incandescent lights in each block. Constructing Engineer W. S. Heald, 216 W. 1st street.

Glyndon, Minn.—A municipal light plant is under consideration. Address M. H. Stadum.

Minneapolis, Minn. — Expenditures aggregating $300,000 for the installation of equipment for an underground pneumatic tube system in the business district, which will connect 10 downtown branches with the main Western Union offices, have been authorized by the executive committees of the Western Union Telegraph Co. L. F. Weise, manager.

Minneapolis, Minn. — Northern States Power Co. will erect a power station in southern Minnesota to take care of increased business. Plant will include 13,500-hp. steam turbine and provision will be made to install a second 20,000-hp. turbine later. R. W. Fuller, vice-president, Minneapolis General Electric Co., 610 3rd Avenue, North.

Davenport, Ia. — New machinery will be installed in the 4-story addition to the Davenport branch of the American Hominy Co., formerly the Purity Oats Co. This building is now practically completed.

Meservey, Ia.—The sum of $93,500 in bonds have been voted for an electric light system. The Iowa Falls Electric Co. will build the line and furnish the current.

Guilford, Mo. — Plans are being made for the installation of electric service from the Maryville Electric Light & Power Co.

Jasper, Mo.—Plans are being made to call a bond election to purchase and improve the light plant.

Slater, Mo. — Election carried to vote $22,500 in bonds for repairs at the city power plant. Plans are being made for the improvements.

St. Louis, Mo.—The Committee on Streets, Sewers and Wharves of the Board of Aldermen of St. Louis have approved a bill providing for the lease by the city to the Union Electric Light & Power Co. of a tract of land at the foot of Ashley street at a rental of $13,807.50 a year. The tract comprises approximately 2 acres. The lease will be for 10 years with an option to be renewed for another 10 years provided that the rental shall be on the basis of 5% per annum upon the valuation of the property.

St. Louis, Mo.—Emerson Electric Manufacturing Co. is selling $1,000,000 preferred stock, the proceeds to be used for the construction of a new factory building immediately adjoining its present St. Louis factory.

St. Louis, Mo.—Blue Bird Manufacturing Co., manufacturer of electrical washing machines, etc., a Delaware corporation, has filed notice with the Secretary of State of an increase in its capital from $500,000 to $1,000,000, to provide for general business expansion.

Burns, Kan. — Election to vote bonds in the sum of $15,000 carried. The funds will be used to build necessary transmission lines to meet the high-voltage lines of the Kansas Gas & Electric Co.

Harper, Kan.—The installation of a white way, to cost $7000, is contemplated. Miss A. E. Crocker, city clerk.

Meridan, Kan.—A petition has been submitted for electric lights.

Milton, N. D.—The committee appointed to get plans for the new electric lighting plant here has completed such plans and will soon begin to advertise for bids.

New Rockford, N. D.—The city will construct "white way" on Willard avenue, Dakota street, Lamborn avenue and Chicago street. F. H. Collins, city auditor.

SOUTH CENTRAL STATES.

Maysville, Ky. — Mason-Bracken Electrical Co., recently incorporated with a capital of $25,000, is planning for the operation of an electric light and power plant at Germantown. Plans are being prepared to furnish service to Brookville and Maysville, a transmission system to be constructed through Maysville via Germantown and Brookville. H. L. Corlis, Germantown, is president of the new company.

Pikeville, Ky.—Kentucky & West Virginia Power Co. will purchase new equipment for its plant.

Yeager, Ky. — Fork-Elkhorn Coal Co. will install electrical equipment.

Birmingham, Ala. — Birmingham Light & Power Co. will erect substations of 1000-kw. capacity, rotary converter with switchboard to supply 250-volt energy to Edison service. L. L. Newman, engineer.

Brundidge, Ala.—G. L. Beck contemplates the installation of a generating unit in the electric plant.

Montgomery, Ala. — Montgomery Light & Water Power Co. is understood to be arranging plans to double the present capacity of its hydroelectric plant. The work will include the construction of a new 44,000-volt high-tension transmission line to connect with the line of similar capacity of the Alabama Power Co., near Vida, on the Mobile & Ohio Railway, about 25 miles northwest of Montgomery. The expansion program is estimated to involve an expenditure of about $500,000. S. B. Irelan is general manager.

Roanoke, Ala. — Alabama Power Co., Birmingham, Ala., will construct a power line to Rock Mills, to furnish electric power to Wehadkee Yarn Mills.

Fort Smith Ark. — Fort Smith Light & Traction Co. is making plans to enlarge its power plant by adding an addition to cost $250,000.

Harrisburg, Ark. — Three brick buildings will be erected by the Harrisburg Light & Power Co. About $20,000 of ice machinery, $30,000 light and waterworks machinery and $20,000 of cotton gin equipment will be installed.

Dewar, Okla.—Dewar Electric Co. is arranging plans for the construction of a new electric light plant to furnish service for local and nearby operations.

El Reno, Okla.—Waterworks improvements are contemplated including pipe line extensions, reservoirs, etc., to cost $300,000. Ethel Deel, city clerk.

Lindsay, Okla. — Election to vote $75,000 in bonds to extend the water works system and $25,000 to extend the electric light system, carried.

Oklahoma City, Okla.—Oklahoma Gas & Electric Co. will construct a station in Western Oklahoma, 10,000-hp. capacity, condensing water from Arkansas river. Address H. M. Byllesby & Co., 208 La Salle street, Chicago, Ill.

Sallisaw, Okla.—About $140,000 will be expended improving the light and water system. Address city auditor.

Tahlequah, Okla.—City will install electric light plant. $1,000,000 in bonds have been voted. Address mayor.

Abilene, Tex. — American Public Service Co. plans to take over and rehabilitate the electric street railway system here. The property has not been operated for some time. Abilene Gas & Electric Co., subsidiary of the American Public Service Co., will expend about $40,000 in making improvements to the system. This company has also begun the construction of a new electric power station here which will cost about $750,000. It will build a system of transmission lines from the new plant to Cisco, Baird, Anson, Stamford, Hamlin, Merkel and other towns of central west Texas, it is announced by A. Hardgrave of Dallas, vice-president and general manager of the American Public Service Co.

Clarendon, Tex. — Texas Light & Power Co. contemplates light plant extensions and improvements. Mr. Coursen, engineer.

Donna, Tex.—Donna Light & Ice Co has increased its capital stock from $10,000 to $40,000. It plans to install new machinery and greatly enlarge the capacity of its electric light and power plant.

Gainesville, Tex. — Gainesville-Sherman Traction Co. has submitted propositions to the citizens of Gainesville, Whitesboro and Sherman looking to the construction of an interurban electric railway between Gainesville and Sherman, about 30 miles. From these three towns a total cash bonus of $175,000 and stock subscriptions to the amount of $275,000 are asked. George M. Easley of Dallas is president and Burt C. Blanton of Dallas is general manager of the company. Construction of the proposed line will be started next February.

Mineral Wells, Tex. — Two allied companies have been organized for the purpose of constructing an interurban electric railway between Fort Worth and Mineral Wells, about 60 miles, and between Mineral Wells and Breckenridge, about 55 miles, with branch lines from the latter town to Eastland, Ranger and Cisco, about 60 miles. One of these companies is the Fort Worth & Mineral

Wells railway and the other is the Fort Worth, Mineral Wells & Breckenridge railway. H. E. Robinson of Fort Worth is president of both companies. Surveys have been made and right of way obtained for the proposed lines, according to Mr. Robinson. Construction will be started early in January.

WESTERN STATES.

Buhl, Ida.—James J. Chambers of Denver, Colo., who owns power rights in Sand Springs, north of Riverside Ferry, and H. E. Lindon, engineer of the firm of Beckman & Linden, San Francisco, met with the citizens of this place recently to discuss propositions of furnishing water to this city from Sand Springs. Chambers stated that if the city would vote bonds for water system and municipal lighting system, his company will supply water and current and take compensation in municipal bonds.

Challis, Ida.—State Public Utilities Commission has granted to W. M. Adamson, authority to begin work on a hydroelectric power plant here, work to begin in 60 days.

Chehalis, Wash. — North Coast Power Co. has filed with the Public Service Commission of Washington, tariffs covering power and residential lighting current, showing increase of rates amounting in some instances to 100%. The company furnishes electric service to Centralia, Chehalis, Tenino, Bucoda, Kelso and Kalema. For supply current to municipal distributing plants, the company establishes a minimum ready-to-serve charge of $600 a month for Chehalis and $1000 a month for Centralia.

Everett, Wash.—Eclipse Mill Co. will make improvements in its plant to cost $25,000. A 2-story building will be constructed equipped throughout with electrically driven machinery.

Matlock, Wash. — District Telephone Co. has decided to extend the line to Sheldon.

Montesano, Wash.—E. H. Bishop, Bishop Lumber Mill, will construct an electrically operated lumber mill with a daily capacity of 60,000 ft.

Seattle, Wash.—Newcomb Carlton, president of the Western Union Telegraph Co., announced that a new cable line will be laid between Seattle and China by way of Japan.

Bend, Ore.—Bend Water, Light & Power Co. contemplates the construction of 2 power plants along the Tumalo river, at a cost of $220,000.

Portland, Ore. — North Portland Box Co. plant, destroyed in a recent fire with a loss of $25,000, will be rebuilt. Machinery will be electrically operated. Coast Steel & Machinery Co. of Portland has contract for a considerable portion of the machinery.

Salem, Ore.—Bend Water Light & Power Co. contemplates construction of power plants on the Tumalo river, at a cost of approximately $230,000.

Redding, Cal.—Pit River Power Co. is completing preliminary survey work in connection with the proposed power development along the Pit river above Copper City. It is said that this work will involve an expenditure in excess of $15,000,000.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Engineering Equipment (31,407).—Engineers in England desire to secure an agency for the sale of engineering equipment (mechanical, electrical and mining). References.

Electrical Apparatus (31,464).—An engineer in the United States who is about to make a visit to Venezuela and Porto Rico, desires to secure the representation of firms for the sale in those countries of machinery, electrical apparatus, automobile trucks, power plants and anything in connection with the mechanical and electrical trades. References.

Electrical Supplies (31,474). — A trade organization in Greece desires to purchase and secure an agency for the sale of electrical supplies. Correspondence may be in English. References.

Electrical Machinery (31,496). — A firm specializing in American electrical manufactures in England desires to secure an agency or purchase electrical machinery and control gear, motors, and generators, alternating and direct current. Will purchase if agency is unobtainable. Quotations should be given c. i. f. English port. References.

Heating Appliances (31,500). — A commercial agent in Belgium desires to secure an agency for the sale of heating appliances, such as valves, radiators, boilers, and similar articles, and to buy various kinds of goods.

Electrical Apparatus (31,503).—An American exporting house which has established branches in all the principal cities of the Levant, and maintains showrooms, warehouses, and service stations, desires to represent American firms for the sale of agricultural machinery, electrical apparatus, automobiles, etc., and all spare parts and accessories thereto. References.

Motors, Compressors, Cranes, Etc. (31,516).—An agency is desired by a firm in Switzerland for the sale of stationary motors and engines driven by gasoline and kerosene; stationary motors driven by electricity, horizontal 20 to 120 h. p.; and compressors, cranes and rigs; and mining machinery. Correspondence may be in English. Reference.

Electrical and Electromechanical Products (31,519). — An importer in Belgium desires to secure an exclusive agency for the sale of electrical and electromechanical products of all sorts. Correspondence and catalogs should be in French. References.

Incandescent Lamps (31,523).—An import and export firm in Bulgaria desires to secure the exclusive agency for the sale of oil and incandescent lamps, sewing and knitting machines, adding and calculating machines, etc. References.

PROPOSALS

Light Plant.—Bids will be received Dec. 31 at Unadilla, Ga., for the erection of an electric light plant and extensions to the waterworks system, which is now being contemplated by the city council. Address mayor.

Electric Light System.—Bids will be received Jan. 5, 1920, by the clerk of the board of education, Ohio National Bank building, Columbus, O., for installing an electric lighting system at the Normal, Fleser, Franklinton, Mound Park and Spring street schools, according to the specifications of D. Riebel, architect, on file in his office, New First National Bank building, and the Builders' Exchange. Edward B. McFadden, clerk.

Rewiring of Building.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Jan. 5, 1920, for remodeling plumbing system, rewiring, etc., in the United States Appraisers Stores, St. Louis, Mo., in accordance with the specifications and drawings, copies of which may be had at that office or at the office of the custodian, St. Louis, Mo., in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Elevators. — Bids will be opened at 3 p. m., Dec. 30, in the supervising architect's office, Treasury Department, Washington, D. C., for the installation complete of two electric elevators in the kitchen and mess hall, United States marine hospital, at New York, N. Y. (Stapleton), in accordance with the drawing and specifications, copies of which may be had at this office in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Freight Lift.—Sealed proposals will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Jan. 8, 1920, for the installation complete of electric freight lift, etc., in the United States post office at Springfield, O., in accordance with the drawing and specification, copies of which may be had at this office in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Telephone Cable and Copper Wire.—Director of Sales, War Department, Washington, D. C., will consider proposals for 1,710,000 ft. of telephone cables and 854,923 lbs. of copper wire. This material was originally packed for overseas shipment and is now available for purchase. It is understood that the greater part of the wire and cable is in the Philadelphia Ordnance District.

Personals

C. P. Bruch Takes Charge of South American Interests, Marconi Telegraph—E. C. Jones a Vice-Pres. of A. S. M. E.

J. W. SMILEY, formerly of the securities department of the Minneapolis General Electric Co. (Northern States Power Co.) has been appointed manager of the new "investment department" of the Louisville Gas & Electric Co.

BURDETT STRYKER, formerly associated with the Chesapeake & Potomac Telephone Co., Washington, D. C., and Baltimore, Md., and later with the Bell Telephone Co. of Pennsylvania, has been appointed general manager of the Chesapeake & Potomac company, Baltimore.

PAUL P. SWEARINGEN has entered the service of the Electric Products Co. in the capacity of sales engineer, making his headquarters at the Chicago office. Mr. Swearingen built the first Liberty motor at the Thomas Morris Aircraft Corp., Ithaca, N. Y., and was transferred as supervisor to the Wright Martin plant, with the rating of captain.

P. R. MCCOMAS has been named general manager of the Illinois Central Electric Railway Co., with headquarters at Canton, Ill. Mr. McComas had had a number of years' experience in both steam and electric railway work and was formerly assistant manager of the Peoria & Pekin Union Railroad Co., Peoria, Ill.

EDWARD F. SISE, president of the Northern Electric Co., Montreal, has resigned. In 1890 Mr. Sise organized the Wire & Cable Co., of which he was managing director until its amalgamation with the Northern Electric Co., at which time he became president of that company. He is succeeded by Paul F. Sise.

J. C. MCQUISTON, manager of the Westinghouse Department of Publicity, East Pittsburgh, Pa., was elected president of the Association of National Advertisers at its annual convention held last week. J. D. ELLSWORTH, publicity manager of the American Telephone & Telegraph Co., New York, was elected a vice-president of the organization.

CLAYTON O. SMITH, the new manager of the O. S. Walker Co., Worcester, Mass., was graduated in 1892 and 1893 as mechanical and electrical engineer, respectively, from Worcester Polytechnic Institute. He then took a student course at the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., following which he accepted a position with the C. W. Hunt Co., Staten Island, N. Y. After 5 years' service with the Norcross Brothers Co., Worcester, in the engineering and drafting department, Mr. Smith became affiliated with the Norton Grinding Co., in its early days, being placed in charge of the drafting department. In 1902 he was promoted to superintendent, in 1905 took charge of the office and 2 years later became sales manager.

HOWARD POWER, secretary of the White Lily Manufacturing Co., Davenport, Ia., manufacturer of electric washing machines, has resigned to become associated with the H. F. Brammer Manufacturing Co., Davenport, effective Jan. 1, 1920.

EDWARD C. JONES, chief engineer of the Pacific Gas & Electric Co., San Francisco, Cal., was elected a third vice-president of the American Society of Mechanical Engineers at its annual meeting held recently. Mr. Jones has taken an active part in the Society's affairs and has been prominently identified with the gas and electric power industry for many years.

PROF. I. O. BAKER has been designated by Dean Charles R. Richards of the college of engineering of the University of Illinois to write a history of the growth and development of the engineering work at the University of Illinois. This history will include the courses in electrical, civil, mechanical, railway, architectural, ceramic and chemical engineering.

WILLIAM LEROY EMMET, consulting engineer of the General Electric Co., Schenectady, N. Y., delivered a very interesting and instructive address on "The Electrical Propulsion of Ships" at a meeting of the New York Electrical Society held on Dec. 17 at the Engineering Societies building, New York City. Mr. Emmet discussed the advantages of the adoption of this method of propulsion in ships of different types and presented valuable engineering data which have recently been developed. Lantern slides of constructions which have been produced or planned were also shown.

CHARLES P. BRUCH, until recently vice-president and director of the Postal Telegraph Co., has just been placed in charge of the interests of the Marconi Wireless Telegraph Co. in a large part of South America and is sailing immediately for Buenos Aires. Himself the son of a distinguished telegraph manager, Mr. Bruch has all his life been engaged in telegraphic operation and administration, and served in the late war as major in the Signal Section of the Officers' Reserve Corps, U. S. Army, and also as a member of the committee on Telegraphs and Telephones of the Council of National Defense. Mr. Bruch is a past-president of the Magnetic Club of New York and the Ohio Society of New York, and is president of the Society of the United States Military Telegraph Corps. He has also taken a prominent part in the affairs of various telegraphic organizations, notably the old time Telegraphers and Historical Society, New York Telegraphers' Aid Society, the Society of the U. S. Military Telegraph Corps and the Telegraph and Telephone Life Insurance Association.

WILMOT L. MATTHEWS and STEPHEN HAAS, both of Toronto, Ont., have been elected directors of the Canadian General Electric Co.

G. E. QUINLAN, chief engineer, Puget Sound Traction, Light & Power Co., Seattle, attended the meeting of the Code Committee of the National Electric Light Association at Denver, Colo.

WALTER BRINTON, general manager of the American Manganese Co., New Castle, Del., has been appointed a member of the Delaware Public Utilities Board, succeeding C. D. Garretson, resigned.

WILLIAM S. BOYD, who for a number of years has been purchasing agent of the Page Steel & Wire Co., Monessen, Pa., has become manager of the steel and iron scrap department of the Thomas D. Prosser Co. He will make his headquarters at the main office of the company at Wooster, O.

P. D. SEXTON, who for several years has occupied the office of secretary and treasurer of the Public Service Co. of Northern Illinois, has been elected an officer of a large bank in Syracuse, N. Y., and will assume his new duties in the near future. He will be succeeded by George R. Jones, assistant to Vice-President J. H. Gulick. Mr. Jones was formerly purchasing agent and was elected to the position of assistant to Vice-President Gulick a few months ago. Both Mr. Sexton and Mr. Jones are widely known and are among the most popular men in the company's organization.

ALBERT E. BERRY, division manager at Philadelphia of the Chesapeake & Potomac Telephone Co. of Philadelphia, has been elected president of the company. He was born in Washington in 1878, and after his graduation in law from Georgetown University about 20 years ago, he entered the offices of a law firm in his native city. In 1901 he entered the service of the Chesapeake & Potomac company as a salesman in the contract department. He later held positions in the office of the general manager and the rights-of-way department, following which he became special agent reporting to the general manager. He then entered the construction department as chief clerk for the Washington division. In 1908 Mr. Berry went to Philadelphia, where he was division manager and where he directed the work of the commercial department during 10 years of unprecedented telephone development.

Obituary.

CHARLES KEITH BLACKWOOD, vice-president of the Sullivan Machinery Co., Chicago, died at his home in Kenilworth, Ill., on Dec. 14. Interment was made in Detroit, Mich. Mr. Blackwood is survived by his widow.

Financial News

Indiana Telephone Companies Merge.

The Indiana Public Service Commission has before it a petition for the consolidation of 8 telephone companies in the vicinity of Seymour into the Southern Indiana Telephone & Telegraph Co. The new company requests permission to issue $300,000 common stock at par; $200,000 of 7% preferred stock at not less than 90% cent of par; and $45,000 of 7% short-time notes at not less than 94. The petition shows that the companies now being merged are worth $239,500, having net assets of $243,000 and gross assets of $300,000. Address L. C. Griffiths, Seymour, Ind.

Public Utility Bond Issues.

Notices have been filed with the Public Service Commission by a large number of public utility companies of the issuance of bonds and stock, for increased operations. Among the companies are: United Gas Improvement Co., Philadelphia, common stock, $5,550,300; Keystone Telephone Co., Philadelphia, bonds, $3,100,000; Penn Central Light & Power Co., Altoona, bonds, $129,000; Philadelphia Suburban Gas & Electric Co., Philadelphia, bonds, $45,000; Eastern Pennsylvania Railways Co., Pottsville, bonds, $42,500; Lycoming Edison Co., Williamsport, notes, $15,000; Citizens Light & Power Co., Oil City, bonds, $16,000; Lehigh Valley Light & Power Co., Allentown, preferred stock, $46,900; State-Centre Electric Co., Clearfield, preferred stock, $100,000; Citizens Traction Co., Oil City, bonds, $100,000; Lehigh Industrial Power Co., Philadelphia, bonds, $33,500; Chester Valley Electric Co., Coatesville, bonds, $630,000; and Conestoga Lawrence Light & Power Co., New Castle, common stock, $1000.

Receivers Operate Sixth of Electric Railway Lines.

"The electric railway industry nearly suffered annihilation through conditions caused by the war," said Gen. Guy Eastman Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., speaking before recent reconstruction conference of the Association of Life Insurance Presidents in New York. Life insurance men, as trustees of approximately $160,000,000 of policy holders' funds invested in street and interurban railroad securities, should, he declared, be deeply interested in the situation.

"With respect to the judgment used in making this investment," continued General Tripp, "the facts are all favorable. From the beginning to the present time street railroads have had all the fundamentals of a sound investment. They furnish now and always have furnished an indispensable service to our urban population. The very existence of modern community life depends upon this form of transportation, and, after water and sewerage, it is the most important public utility. In short, if our urban communities have made for the wealth, comfort and culture of this country, then an investment in street railway transportation is in one of the cornerstones of the structure; and, if the investment is in danger, it is not because of poor financial judgment.

"More than a sixth of the total electric railway mileage of the country is in the hands of receivers. A very large additional number of companies are on the verge of bankruptcy, some of them kept from this fate only by the financial strength of the much criticized 'holding' companies. Alone of the important industries of the nation, the electric railway industry nearly suffered annihilation through conditions caused by the war, and back of all these facts is the further and by all means the most important fact that the industry, by reason of restrictions in statute law, in ordinances and by franchises is unable to take measures to save itself from the fate which events show to be imminent.

"The restoration of credit is fundamental to the continuance of private capital and private enterprise in the public service, and the main task that confronts the country, insofar as the electric railways are concerned, is the restoration and the future preservation of that credit.

"The street railway problem has passed the stage where it is simply a concern of the owners and operators of the properties. They have lost and are losing a great many millions of dollars, and for them the situation is deplorable enough, but the communities, and through the communities you men of business, the workmen, the ordinary everyday citizens, are today threatened with the loss or demoralization of a service that is absolutely necessary if business is to continue in our large urban centers, if the health and morals and comfort and convenience of our citizens are to be preserved."

Adoption by municipalities and street railway companies of "cost and service agreements" in which the cost of maintaining the integrity of the investment is included was recommended as a means of giving the street railway financial problems by General Tripp.

Business of General Electric Company Increasing.

General Electric Co. is enjoying unprecedented prosperity explaining the stock's refusal to participate in the recent break in the general market. Goods are now being shipped at the rate of $20,000,000 monthly, a volume in excess of the highest point attained during the war period.

Business was slack in the four or five months following the signing of the armistice, but the recovery has been so rapid since that time that billings for the entire year should average $18,500,000 monthly, bringing the aggregate for 1919 to around $225,000,000, against $216,815,277 in 1918.

Bookings are now being received at an annual rate that betters the showing made in 1918 when orders aggregated $234,134,037. For the first nine months of this year the annual rate of bookings ran less than $200,000,000, but the improvement since then has been so striking that the total for 1919 should be higher than the preceding year's figure.

Applying General Electric's 1918 ratio of manufacturing costs to $225,000,000 gross indicated for 1919, earnings of $15.70 a share, after taxes, are shown for the approximately $20,000,000 stock which will be outstanding at the close of the year. This compares with $14.76 a share earned on $115,874,800 stock in 1918.

An outstanding feature of General Electric's financial position is the great strength of its working capital. Cash on hand at the close of 1918 was $34,010,024, against $21,190,675 at the start of the year. Total net quick assets as of Dec. 31, last, were $180,298,731. Excluding the $10,000,000 6% notes which were paid off Dec. 1, 1919, current liabilities as of Dec. 31, 1918, were $27,416,082. This left working capital of $152,882,649, equal to $132 a share on $115,874,800 stock outstanding at the close of last year.

Pacific Gas & Electric Earnings Show Improvement.

Report of earnings of Pacific Gas & Electric Co. for the 12 months to Oct. 31, 1919, shows considerable increase in both gross and net indicating that the fiscal year ending Dec. 31 next should be a record year. Gross earnings for the 12 months to Oct. 31 were close to the $26,000,000 mark. This does not include earnings of the Northern California Power Co. purchased by Pacific Gas & Electric Co. recently and which in 1918 reported gross earnings of $1,154,943.

Earnings report for the 12 months to Oct. 31, 1919, compared with previous 12-month period follows:

	1919.	1918.
Total gross inc. misc. inc.	$25,999,888	$22,397,899
Net after taxes	8,748,201	7,876,925
Surplus after fixed charges	4,325,871	3,570,376

There was paid out in dividends on the preferred stock $1,528,997, leaving $2,796,894 earned on the common stock. Surplus after charges of Northern California Power Co. amounting to $340,000 theoretically should be brought in, inasmuch as Pacific company owns this company and its surplus accrues directly to it.

The company during the 12 months charged off for depreciation $3,277,437, compared with $2,796,510 the previous 12 months. This does not include the special depreciation charge of $1,000,000 ordered by the California Commission for seven years. As the company is retiring bonds at the rate of this amount annually, this is not generally considered a proper charge upon earnings. On this basis, the company is earning at the rate of between $8 and $9 a share annually on the common stock. This does not include revenue to be derived from Northern California Power Co.

Water conditions this fall have not been of the best, but it is reported that rains and snow fell commencing the latter part of November, which will improve the situation.

The full effect of the acquisition of the plants and transmission lines of Sierra & San Francisco Power Co. will be in the future rather than immediately. The Sierra company in 1918 earned little more than approximately $66,000 in excess of its fixed charges, just about the amount which the company will pay for its rental during the first year. The rental of the properties will give Pacific company an opportunity to increase its hydroelectric output, which is believed to be the reason for the taking over of this system.

Dividends.

Central States Electric Corp. has declared a regular quarterly dividend of 1¾% on preferred stock, payable Dec. 31 to stock of record Dec. 10.

New York Telephone Co. has declared a semi-annual dividend of 3%, payable Jan. 1.

A quarterly dividend of 1¾% on preferred stock has been declared by the Utah Power & Light Co., payable Jan. 2 to stockholders of record Dec. 16.

Dayton Power & Light Co. has declared a quarterly dividend of 1½% on preferred stock, payable Jan. 2 to stock of record Dec. 20.

Northwest Telephone Co. has declared a semi-annual dividend of $5 per share, payable Jan. 1.

The Illinois Traction System has declared a quarterly dividend of 1½%, payable Jan. 1, 1920, to stockholders of record Dec. 15, 1919.

Electric Storage Battery Co. has declared a quarterly dividend of 2½%, also a dividend of 2½% on preferred stock, payable Jan. 2, 1920, to stock of record Dec. 15.

Manhattan Electrical Supply Co. has declared a quarterly dividend of 1%, a quarterly dividend of 1¾% on first preferred stock, and a quarterly dividend of 1¾% on second preferred stock, payable Jan. 2. 1920, to stockholders of record Dec. 30.

Eastern Texas Electric Co. has declared a cash dividend of $4 per share, also a semi-annual dividend of $3 on preferred stock, payable Jan. 2 to stock of record Dec. 15.

Niagara Falls Power Co. has declared the quarterly dividend of $1 a share on common stock and $1.75 on the preferred

For the Readjustment Period—What?

LXI.

Higher Costs Ahead

I do not think that all commodity prices have reached their peak. I base that conclusion on many facts, foremost of which is world scarcity of goods. Years will pass before world production can again become normal. Two illustrations show the widespread want of necessities. Europe has only 55 per cent of its food requirements; it needs more than four and one-half billion bushels of grain, for instance, and there is available in all the world only about one billion bushels.

Europe's shortage of coal is in excess of two hundred million tons. That means, of course, greatly decreased production, as well as intense suffering. Europe must have these necessities, and, consequently, as the law of supply and demand is ever operative—despite legislative enactments and bureaucratic decrees designed to suspend such fundamental economic laws—there is seemingly little prospect of materially reduced prices, at least for the immediate future.

And surely we cannot reasonably expect commodity prices to decrease in this country while there exists here the present epidemic of strikes, especially in such industries as coal and steel, which lower our production not only in those industries, but, by virtue of their basic character, in practically all other industries.

We cannot hope to reduce the cost of living when the individual output of American workmen has declined, on an average, from 15 to 50 per cent in the last year or two, although he has obtained—if not wholly earned—unprecedented increases in wages.

It has aptly been pointed out that the simplest mind can grasp the meaning of this deplorable situation—to wit: If a greater number of people must be employed to turn out the same quantity of goods as before, the cost of the goods must be increased. This increase comes simultaneously with increase of wages. Plainly the country is taxing itself in high prices in order that some of its inhabitants may indulge a slothful spirit.

As a concrete example, the Pennsylvania Railroad has 14 per cent more employes than before we entered the war, but gets 11 per cent less work from them. In other words, it requires 127 men today to do the work of 100 in 1917. The fact that the employes now work only eight hours a day instead of ten, as in 1917, does not account for the decrease in results, because even with a 20 per cent reduction in time, were the men to work with the same effort they did in 1917 they would be able to move 91,000 traffic units a day instead of only 89,000, the present daily average.

We cannot hope to ameliorate the tax burden very materially, and thereby lessen its power in raising costs all around, if Congress appropriates practically five billion dollars for conducting the peace time activities of the government during the coming fiscal year—which is the aggregate amount of proposed appropriations submitted to Congress by the Secretary of the Treasury a few days ago, and which is five times as large as the sum required to transact government affairs in the year immediately preceding the world war.

I do not advocate niggardliness in government expenditures, but I must assuredly declare for common sense economy, such as any large business corporation would practice, and I am a firm believer in a practical budget system for the government, which should be adopted without further delay.

FRANCIS H. SISSON, V. P.,
Guaranty Trust Co.,
New York.

stock. The former is payable Dec. 15 to stock of record Dec. 10 and the latter on Jan. 15, 1920, to stock of record Dec. 31.

Buffalo General Electric Co. has declared a dividend of 2%, payable Dec. 31 to stock of record Dec. 20.

American Power & Light Co. has declared a quarterly dividend of 1½% on preferred stock, payable Jan. 2 to stock of record Dec. 17.

Penn Water & Power Co. has declared a quarterly dividend of 1½% on common stock, payable Jan. 2 to stock of record Dec. 19.

A dividend of $2 per share has been declared by the American Telephone & Telegraph Co., payable Jan. 15, 1920, to stockholders of record Dec. 20.

The regular quarterly dividend of 1¾% on preferred stock has been declared by the American Gas & Electric Co., payable Feb. 2, 1920, to stockholders of record Jan. 16, 1920.

Earnings.

ASSOCIATED GAS & ELECTRIC CO.

	1919	1918
September gross	$ 107,960	$ 96,836
Net after taxes	30,583	21,443
Surplus after charges	9,215	515
Twelve months gross	1,190,348	971,763
Net after taxes	334,524	224,291
Surplus after charges	80,692	*22,909

*Deficit.

AUGUSTA-AIKEN RAILWAY & ELEC. CORP.

	1919	1918
September gross	$ 91,235	$ 86,366
Net after taxes	32,417	38,979
Surplus after charges	2,068	10,937
Twelve months gross	1,035,203	1,064,014
Net after taxes	328,307	510,464
Deficit after charges.	39,120	*144,153

*Surplus.

HELENA LIGHT & RAILWAY CO.

	1919	1918
October gross	$ 29,101	$ 25,009
Net after taxes	4,758	2,439
Surplus after charges	495	*1,907
Twelve months gross	343,695	318,787
Net after taxes	55,491	61,595
Surplus after charges	3,508	4,233
Balance after pfd. div.	3,508	*12,909

*Deficit.

UNITED LIGHT & RAILWAYS.

Chicago—United Light & Railways Co. reports earnings as follows:

	1919	1918
October gross	$10,056,109	$9,024,302
Net after taxes	2,913,822	2,647,610
Surp. after charges.	518,592	358,549

MANILA ELECTRIC R. R. & LIGHTING CORP.

	1919	1918
August gross	$ 194,006	$ 205,666
Net after taxes	42,077	95,856
Surplus after charges	6,084	67,433
Twelve months gross	2,481,308	2,095,793
Net after taxes	963,111	973,688
Surplus after charges	556,208	633,473
Bal after dividends..	256,208	333,473

NEVADA-CALIFORNIA ELECTRIC CORP.

Combined earnings of Nevada-California Electric Corp. and subsidiaries, intercompany items eliminated, compare as follows:

	1919	1918
October gross	$ 189,261	$ 176,640
Net after taxes	98,162	105,370
Surplus after charges	*5,778	*25,260
Ten months gross	2,180,007	1,844,277
Net after taxes	1,205,542	960,706
Surplus after charges	*328,673	*200,755

*After appropriation for redemption of bonds.

SOUTHERN UTILITIES CO.

	1919	1918
September gross	$ 166,280	$ 129,140
Net after taxes	28,985	3,223
Surplus after charges	10,403	*12,034
Twelve months gross	1,832,613	1,469,835
Net after taxes	161,182	218,978
Deficit after charges.	51,407	§35,602
Deficit after pfd. div.	51,407	§9,002

*Deficit. §Surplus.

NATIONAL CONDUIT & CABLE.

Estimated income account of National Conduit & Cable Co., Inc., for nine months ended Sept. 30, 1919, shows deficit, after charges and taxes, of $859,188, as compared with $877,848 in the corresponding period of 1918.

Earnings for 9 months ended Sept. 30, 1919, compares as follows:

	1919	1918
Net sale	$7,077,046	$10,790,010
Mfg. cost and exp.	7,583,684	11,011,207
Loss from oper.	$ 506,638	$ 221,197
Other income	104,387	66,356
Total deficit	$ 402,251	$ 154,841
Tax, int. and deprec.	*456,937	723,007
Deficit	$ 859,188	$ 877,848

*Includes depreciation and organization expense written off $190,494.

NORTHERN OHIO ELECTRIC.

Earnings of Northern Ohio Electric Corp. for October, 10 and 12 months ended Oct. 31, compares as follows:

	1919.	1918.
October gross	$ 796,765	$ 585,622
Net earnings	241,088	158,283
Surplus after charges	70,787	15,187
Balance after preferred dividend	40,787	*14,812
10 months' gross	7,528,102	5,997,743
Net earnings	2,531,304	2,062,121
Surplus after charges	857,197	629,111
Balance after preferred dividend	557,197	329,111
12 months' gross	8,824,539	7,121,473
Net earnings	2,948,950	2,463,171
Surplus after charges	934,216	731,940
Balance after preferred dividend	574,216	371,940

*Deficit.

DETROIT EDISON.

	Month of Oct., 1919	Month of Oct., 1918	10 Months of 1919	10 Months of 1918
Operating Revenue:				
Commercial Electric Revenue	1,308,081.65	1,088,919.82	10,933,213.31	9,187,806.26
Municipal Electric Revenue	29,906.07	26,640.78	289,163.72	263,841.16
Sales to Street Railways	89,188.21	68,241.98	811,215.89	701,738.98
Sales to Other Pub. Ser. Corp.	17,710.29	12,827.29	148,401.25	121,092.46
Miscellaneous Revenue	568.23	382.33	6,149.57	23,430.24
Non-Operating Revenue:				
Steam Sales	64,225.18	55,388.83	722,802.35	626,338.15
Other Non-Operating Revenue	29,593.18	15,888.14	219,856.63	139,711.27
Total Gross Revenue	1,539,272.81	1,268,289.17	13,130,801.92	11,063,958.52
Expenses:				
Operating and Non-Operating (except Renewal, Replacement and Contingent)	1,081,470.00	822,079.47	9,074,286.17	7,546,103.38
Renewal, Replacement and Contingent (Depreciation Reserve)	101,000.00	89,695.00	701,000.00	651,090.00
Total Operating and Non-Operating Expenses	1,182,470.00	911,774.47	9,775,286.17	8,197,193.38
Net Income	356,802.81	356,514.70	3,355,515.75	2,866,765.14
Deductions from Income:				
Interest on Funded and Unfunded Debt	148,548.67	128,257.93	1,407,830.09	1,096,262.28
Other Deductions				
Total Deductions	148,548.67	128,257.93	1,407,830.09	1,096,262.28
Net	208,254.14	228,256.77	1,947,685.66	1,770,502.86

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate Per cent.	Bid Dec. 9.	Bid Dec. 16.
Adirondack Electric Power of Glens Falls, common	6	14	15
Adirondack Electric Power of Glens Falls, preferred	6	76	77
American Gas & Electric of New York, common	10+extra	124	123
American Gas & Electric of New York, preferred	6	39	39
American Light & Traction of New York, common	..	208	195
American Light & Traction of New York, preferred	6	92	92
American Power & Light of New York, common	4	60	63
American Power & Light of New York, preferred	6	73	73
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	22	21
American Telephone & Telegraph of New York	..	99¼	99⅛
American Water Works & Elec. of New York, common	..	3	2
American Water Works & Elec. of New York, particip	7	9	6
American Water Works & Elec. of New York, first preferred	..	45	45
Appalachian Power, common	..	4	3
Appalachian Power, preferred	7	21	20
Cities Service of New York, common	+extra	405	402
Cities Service of New York, preferred	6	73½	72
Commonwealth Edison of Chicago	8	108	107
Comm. Power, Railway & Light of Jackson, common	..	21	20
Comm. Power, Railway & Light of Jackson, preferred	6	45	..
Federal Light & Traction of New York, common	..	7	7
Federal Light & Traction of New York, preferred	..	42	42
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	..
Middle West Utilities of Chicago, preferred	6	48	..
Northern States Power, of Chicago, common	..	63	63
Northern States Power of Chicago, preferred	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common	..	63	60
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	80	78
Public Service of Northern Illinois, Chicago, preferred	6	85	89
Republic Railway & Light of Youngstown, common	4	13	12
Republic Railways & Light of Youngstown, preferred	6	48	46
Standard Gas & Electric of Chicago, common	..	27½	27¼
Standard Gas & Electric of Chicago, preferred	6	41¾	41
Tennessee Railway, Light & Power of Chattanooga, common	..	3	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	5
United Light & Railways of Grand Rapids, common	4	41½	..
United Light & Railways of Grand Rapids, preferred	6	67	60
Western Power of San Francisco, common	..	27	21
Western Union Telegraph of New York	extra	89½	87
Industries.			
Electric Storage of Philadelphia, common	4	137	132½
General Electric of Schenectady	8	168	166
Westinghouse Electric & Mfg. of Pittsburgh, common	7	53½	52¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..